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? QUIZ-COMPEND ? NO. 11.

A

COMPEND

OF

PHARMACY.

BY

F. E. STEWART, M.D., PH.G.,

DEMONSTRATOR IN MATERIA MEDICA AND PHARMACY, JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.

FORMERLY QUIZ-MASTER IN CHEMISTRY AND THEORETICAL PHARMACY IN THE PHILADELPHIA COLLEGE OF PHARMACY; INSTRUCTOR OF PHARMACY AND MATERIA MEDICA IN THE MEDICO-CHIRURGICAL COLLEGE OF PHILADELPHIA; LECTURER ON, AND DEMONSTRATOR OF, PHARMACY IN THE WOMAN'S MEDICAL COLLEGE OF PENNSYLVANIA.

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PREFACE TO THIRD EDITION.

Judging from the many letters received by the author, and the fact that this little Compend is now in its third edition, he is led to believe that the work has become a very popular one. He is also struck with the fact that the book is used by physicians in active practice as a reference for the purpose of "brushing up" the memory, as one graphically put it. To fit it for this varied service the author has made a number of improvements which he feels sure will greatly add to the value of the book.

The table of contents has been abbreviated, and now comprises simply chapter headings, and mention of important sub-heads. An index has been added, made according to an improved plan, whereby each subject can be referred to in the most convenient manner. There has also been incorporated in the work, by special permission of the United States Coast and Geodetic Survey, comparative tables of weights and measures, which in themselves are worth more than the price of the book. These tables are for converting weights and measures in common use into the metric system, and for converting metric system into the system in common use. It is said by all authorities to be the most practical working plan yet adopted. As the U. S. Pharmacopœia of 1890 will adopt the metric system in its purity, and leave out mention of other systems, a thorough knowledge of the former is of the greatest importance to both pharmacists and physicians.

F. E. STEWART.

PREFACE TO FIRST EDITION.

The collection of substances employed in medicine is called the MATERIA MEDICA: the substances themselves are known as drugs. PHARMACY is the science of preparing these substances: THERAPY is the science of applying them to the treatment of the sick. These three branches are properly classified under the general head PHARMACOLOGY, or the SCIENCE OF DRUGS.

To prepare drugs properly, a knowledge of their properties is necessary. The pharmacist must have a knowledge of their physical properties to identify them, of their chemical properties to select the proper menstruums for extracting their medicinal virtues, and a knowledge of their therapeutical properties to prepare them in the best manner to meet the indications of a rational therapeutics. The neglect of this latter branch on the part of the pharmacist has too often resulted in a sacrifice of therapeutic efficacy to obtain pharmaceutical elegance. The former is the principal object to aim for, though the latter is very important, for it is apparent that the most elegant pharmaceutical preparation, if it have not therapeutic value, is worse than useless.

The importance of studying these three branches together will, therefore, be appreciated. Works on pharmacy recognize this importance to a greater or less degree, and embrace, in proportion as the author views the subject from this point of view, a comprehensive Pharmacology. Though, in the opinion of the author, no work has yet been written that brings therapy and modern pharmacy close enough together, it is not his object in the following pages to make the attempt.

It is not the object of a QUIZ-COMPEND to teach new facts. It is its object, rather, to present facts already well known to science in a form easy to comprehend, for the purpose of aiding the student in memorizing them. And as the immediate end which the student is seeking to attain is the passing of his examination in a creditable manner—this end has been carefully considered by the author in writing the following pages.

Quizzes are reviews and explanations of the teachings of others. It is the purpose of the author to observe this rule; and in so doing he has followed, in the main, the leadership of his esteemed friend and teacher,

Professor Joseph P. Remington, of the Philadelphia College of Pharmacy, whose excellent work in the Committee for the Revision of the United States Pharmacopœia, and on the United States Dispensatory, and more recently displayed in his masterly treatise, "The Practice of Pharmacy," justly entitle him to the great reputation which he has acquired as one of the greatest of modern teachers in the branch of knowledge under consideration.

Finally, it must be remembered that a QUIZ-COMPEND is not a *text-book*. It is intended for the sole purpose of aiding the student in connection with his lecturer and text-book, and will not do as a substitute for either.

F. E. STEWART.

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THE PREPARATIONS OF THE ORGANIC MATERIA MEDICA.

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INTRODUCTORY.

PHARMACOPŒIAS AND DISPENSATORIES.

What is a Pharmacopœia? A Pharmacopœia is an authoritative list of medicinal substances, with formulas for their preparation.

The necessity for authoritative standards to define the character, establish the purity, and regulate the strength of medicines, is recognized by all civilized nations. The most important of these works, with the date of their last issue now extant, are as follows: U. S. Pharmacopœia (1882);[1] British Pharmacopœia (1885); Pharmacopœia Germanica (1882); Codex Medicamentarius (Pharmacopée Française)—France (1884); P. Austriaca—Austria (1869); P. Rossica—Russia (1880); P. Suecica—Sweden (1869); P. Norvegica—Norway (1879); P. Danica—Denmark (1868);[2] P. Belgica—Belgium (1881); P. Helvetica—Switzerland (1872);[3] Farmacopea Español—Spain (1865); Pharmacopêa Portugueza—Portugal (1876); P. of India 1868);[4] P. Hungarica—Hungary (1871); P. Neerlandica—Netherlands (1871); P. Româna—Roumania (1862); P. Fenica—Finland (1863); ΕΛΛΗΝΙΚΗ ΦΑΡΜΑΚΟΠΟΙΙΑ—Greece (1868); Nueva Farmacopea Mexicana (1884). Italy, Chili and Japan, each have a P. in preparation.

Countries having no national Pharmacopœia adopt the standard of other countries, or supply standard pharmaceutical works for the same purposes.

The Pharmacopœias of all nations except our own are issued under the authority of the respective governments, and therefore partake of the nature of laws.

The U. S. P. was originally devised, and is decennially revised, by a committee appointed from the professions of medicine and pharmacy. It should be a representative list of the drugs and preparations employed in therapeutics.

How many crude drugs and preparations are mentioned in the U. S. P. of 1882? 997.

Why was the former classification of these substances into Materia Medica and Preparations dropped in the last revision of the U. S. P.? To disarm criticism upon a mode of classification, and facilitate ready reference.

[1] Should have been issued in 1880.
[2] Additions, 1874, 1876.
[3] Supplement, 1876.
[4] Supplement, 1869.

NOMENCLATURE OF THE UNITED STATES PHARMACOPŒIA OF 1882.

How are the titles of the medicinal substances indicated in the U. S. P. of 1882? 1, by the Officinal Name, which is always in Latin; 2, by the English Name; 3, by the Synonyme; 4, by the Botanical Name (in the case of plants); 5, by the Symbolic Formulæ (in the case of chemicals).

Give examples of each. Cannabis Indica (officinal name). Indian Cannabis (English name). Indian Hemp (Synonyme). Zinci Iodidum (O. N.). Iodide of Zinc (E. N.). ZnI_2; 318.1—*ZnI*: 159.05 (Symbolic Formulæ). Prunus Virginiana (O. N.). Wild Cherry (E. N.). The Bark of Prunus serotina (Botanical name).

1. **The Officinal Name.—When is the use of the officinal name proper?** In designating the drug when precision is required—labels, prescriptions, specimens, etc.

Why is the Latin language employed for the officinal name? Because it is a dead language and is not liable to change, as in the case of a living tongue.

2. **The English Name.—When should the English name be employed?** In ordinary conversation, in commercial transactions, and in all cases "where the use of the Latin officinal name could be justly criticised as an ostentatious display of erudition."

3. **The Synonyme.—When should the synonyme be used?** The synonyme should be rarely or never used. The synonyme is usually antiquated and from an unscientific source, but on account of long usage in common language synonymes cannot be completely ignored.

4. **The Botanical Name.—What is meant by the botanical name?** "By this is meant the systematic name recognized by botanists for plants, which serves in pharmacopœial nomenclature as the basis of the officinal name."

Capsicum fastigiatum is the botanical name for the variety of Cayenne pepper designated by the U. S. P. Capsicum indicates the genus, fastigiatum the species to which the plant belongs. Then follows the definition, which shows what part of the plant is employed, "the *fruit* of Capsicum fastigiatum."

When should a capital letter be employed in writing the specific name? 1. When derived from a generic name, as *Rhamnus Frangula;* 2. When derived from the name of a person, as *Strychnos Ignatii;* 3. When indeclinable, as *Erythroxylon Coca.*

The name of the author follows the botanical name, as *Capsicum fastigiatum* Blume, then the natural order to which the plant belongs, in italics, and the whole enclosed in parentheses, as (Nat. Ord., *Solanaceæ*).

When should the botanical name be employed? Its use is absolutely necessary in establishing the identity of drugs.

5. **The Symbolic Formulæ.—What is meant by the symbolic formulæ?** The symbolic formulæ are combinations of symbols representing the chemical structure of the articles to which they refer with the utmost brevity and exactness.

NaI means the same as Sodii Iodidum and Iodide of Sodium, but it is

shorter and much more definite. $(ZnCO_3)_2 3Zn(HO)_2$ means that precipitated carbonate of zinc consists of two molecules of carbonate of zinc and three molecules of hydrate of zinc. $Na_2SO_3.7H_2O$, means that sulphite of sodium containing seven molecules of water of crystallization, and no other sulphite of sodium.

Both the new and the old chemical nomenclature are used by the U. S. P. in expressing symbolic formulæ—the latter in italics—but the former is to be preferred.

The figures following the symbolic formulæ express the molecular weight (the sum of the weight of the atoms) of the chemical. For example, the molecular weight of $Na_2SO_3.7H_2O$ is 252. Na weighs 23; two atoms are employed, which equals 46. S weighs 32. O weighs 16; three atoms are employed, which equals 48. H weighs 1; two atoms are employed, which equals 2. O weighs 16, which added to 2 = 18. H_2O is taken 7 times; 7 times 18 equals 126. $46 + 32 + 48 + 126 = 252$, the molecular weight of sulphite of sodium.

This matter of atoms and molecular weights can be made clear to the student by the following illustration: A pays B 100 sovereigns, English money, in sovereigns and half sovereigns, giving him 50 of the former and 100 of the latter; how much will the 100 sovereigns of gold weigh?

1 sovereign weighs	124 grains	× 50 =	6200 grains.
½ "	" 62 "	× 100 =	6200 "
Weight of 100 sovereigns in gold,			12400

In the same way the molecular weight of water (H_2O) is 18.

H, Hydrogen atom, weighs	1 × 2 =	2
O, Oxygen atom, "	16 × 1 =	16
Molecular weight of H_2O,		18

Officinal Description.—Immediately following the officinal definition, there will be noticed in the Pharmacopœia, in smaller types, what has been termed the officinal description: of what does this description usually consist? (A) In drugs—1, a concise statement of physical characteristics; 2, tests of identity; 3, description of adulterants. (B) In chemicals—1, statement of physical characteristics, as in case of drugs; 2, solubilities; 3, tests of identity and purity.

State some of the advantages of the principle of "parts by weight" and centesimal ratio adopted by the U. S. P. in 1882. This system "renders the calculation of the numerical weight relation of the ingredients very simple, it being a question of percentage."

Illustrate this. Compound pills of Rhubarb contain Rhubarb, 200 grains; Purified Aloes, 150 grains; Myrrh, 100 grains; Oil of Peppermint, 10 grains; to make 100 pills. "By simply pointing off decimally, we find that each pill contains 2 grains of Rhubarb, 1½ grains of Aloes, 1 grain of Myrrh and $\frac{1}{10}$ of a grain of Oil of Peppermint."

DISPENSATORIES.

What is a Dispensatory? A Dispensatory is a Commentary on a Pharmacopœia.

What do Dispensatories aim to present? The Dispensatories generally aim to present information concerning important non-officinal drugs and those officinal in other Pharmacopœias as well as those of the U. S. P.

What Dispensatories have we in the U. S.? We have in this country The United States Dispensatory, National Dispensatory and King's Dispensatory.

PART I.

METROLOGY.

WEIGHT, MEASURE AND SPECIFIC GRAVITY.

What is weight? Weight is the difference between the attraction of the earth and that of surrounding bodies for bodies on the surface of the earth.

Upon what does the weight of a body depend? Upon its bulk and density. Density is the amount of matter in given bulks of bodies.

What is meant by weighing? Balancing a body of known gravitating force with one whose gravity is not known, for the purpose of estimating the gravitating force of the latter, which is called its weight.

What are weights? Bodies of known gravitating force used for weighing.

What name is given to the apparatus used for weighing? Scales and weights.

What standards are used upon which to base the system of weights? The Grain and the Metre.

How was the grain weight derived? By act of Henry III of England, in 1226; "An English silver penny, called the sterling, round and without clipping, shall weigh *thirty-two grains of wheat*, well dried and gathered out of the middle of the ear."

What is a Metre? One 40 millionth of the circumference of the earth at its poles.

What systems of weights used in Pharmacy are based on the Grain? The Troy or Apothecaries' system and the Avoirdupois system.

State the denominations of each. *Troy or Apothecaries' Weight:* 20 grains = 1 scruple; 3 scruples = 1 drachm; 8 drachms = 1 ounce; 12 ounces = 1 pound. *Avoirdupois Weight:* 437½ grains = 1 ounce; 16 ounces = 1 pound.

State the Symbols of each. *Troy:* grain, or grains, gr.; scruple, ℈; drachm, ʒ; ounce, ℥. *Avoirdupois:* ounce, oz.; pound, lb.

How many grains do the ounce of each system contain, respectively, and what is the difference in grains between the Troy and Avoirdupois ounce? Avoirdupois ounce = 437½ gr.; Troy ounce = 480 gr. Troy ounce 42½ grains greater.

What is the difference in grains between the Avoirdupois and Troy pound? Avoirdupois pound, 7000 grs.; Troy pound, 5760. Avoirdupois pound, 1230 grains greater.

What is Measure? The bulk or extension of bodies.

What Systems of Measure are used in Pharmacy? Apothecaries' or Wine Measure, Imperial or British Measure, and the Metric System.

State the denominations of each. *Apothecaries' Measure:* 60 minims = 1 fluidrachm; 8 fluidrachms = 1 fluidounce; 16 fluidounces = 1 pint; 8 pints = 1 gallon. *Imperial Measure:* 60 minims = 1 fluidrachm; 8 fluidrachms = 1 fluidounce; 20 fluidounces = 1 pint; 8 pints = 1 gallon.

State the Symbols of each. *Apothecaries' Measure:* Minim, ♏; fluidrachm, f ʒ; fluidounce, f ℥; pint, O; gallon, Cong. *Imperial Measure:* Minim, min.; fluidrachm, fl. dr.; fluidounce, fl. oz.; pint, O; gallon, C.

State the relations of Apothecaries' and Imperial Measures to Troy and Avoirdupois weights. *Apothecaries' Measure:* The pint of distilled water at 15.6 C. (60° F.) weighs 7291.2 grs.; the fluidounce, 455.7 grs.; the gallon, 8.3328 pounds avoirdupois. *Imperial Measure:* pint weighs 8750 grs.; fluidounce, 437.5 (which is the same as the avoirdupois ounce, and 18.2 grs. less than that of the U. S. fluidounce of water at the same temperature); gallon, 10 pounds avoirdupois.

What is a Metre? The unit of length of the Metric, French or Decimal system, from which all other denominations are derived.

How was it obtained? It was obtained by a measurement of the quadrant of a meridian of the earth, and is about $\frac{1}{10000000}$ of the circumference of the earth at the poles.

What is it practically? Practically, it is the length of certain carefully preserved bars of metal from which copies have been taken.

What is its equivalent in feet and inches? It is equal to about 3 ft. 3 in. and ⅜ in.

What is the unit of surface, and how derived? The unit of surface is the Are, which is the square of ten metres (the square of a decametre) = a square whose side is 11 yards.

What is the unit of capacity, and how derived? The *Litre*, which is a cube of a tenth of a metre (the cube of a decimetre) = 2.1134 pints.

What is the unit of weight, and how obtained? The unit of weight is the *Gramme*, which is the weight of that quantity of distilled water, at its maximum density (4°C.), which fills the cube of the one-hundredth part of the metre (cube of a centimetre, or in other words, cubic centimetre, c.c.), = 15.43235 grains or about 15½ grains.

How are the denominations of the Metric System multiplied and divided? They are multiplied by the Greek words, "Deca," Ten; "Hecto," Hundred; "Kilo," Thousand; and divided by the Latin words, "Deci," one-tenth; "Centi," one-hundredth; "Milli," one-thousandth.

TABLE SHOWING HOW METRIC UNITS ARE MULTIPLIED AND DIVIDED.

Quantities.	Length.	Surface.	Capacity.	Weight.
1000	Kilo-metre.	. . .	Kilo-litre.	Kilo-gramme.
100	Hecto-metre.	Hectare.	Hecto-litre.	Hecto-gramme.
10	Deca-metre.	. . .	Deca-litre.	Deca-gramme.

TABLE FOR MULTIPLYING AND DIVIDING METRIC UNITS.—*Continued.*

Quantities.	Length.	Surface.	Capacity.	Weight.
1 (Units.)	METRE.	ARE.	LITRE.	GRAMME.
.1	Deci-metre.	. . .	Deci-litre.	Deci-gramme.
.01	Centi-metre.	Centare.	Centi-litre.	Centi-gramme.
.001	Milli-metre.	. . .	Milli-litre.	Milli-gramme.

—(Attfield.)

Describe the use of the Gramme and Cubic Centimetre (fluigramme) as units of weight and measure. In the practical working of a laboratory, the Gramme and its divisions are used for weighing, and the cubic centimetre (c.c. or fluigramme) for measuring liquids. A gramme and a cubic centimetre of distilled water are identical, but owing to greater or less density, cubic centimetres of other liquids weigh more or less than a gramme. But if the c.c. is taken as a unit of capacity only, and the gramme as the unit of weight, all difficulty is avoided. For example, dissolve 1 gramme of sugar in sufficient quantity of water to make 10 c.c. It is evident that each c.c. of this solution contains 1 deci-gramme of sugar. By keeping the c.c. intact and varying the strength of the solution, each c.c. can be made to contain any stated amount of sugar from saturation to infinity.

TABLE OF EQUIVALENTS.

One Cubic Centimetre = 16.23 Minims.
Four " " = 1.08 Fluidrachms.
Thirty " " = 1.01 Fluidounces.
One Minim . . . . = 0.06 c.c.
Four " . . . . = .25 "
Ten " . . . . = .62. "

One Troy drachm = 3.888 Grammes.
One Troy ounce = 31.103 "
One Avoird. ounce = 28.35 "

Explain the signification of the Micromillimetre and the Kilo. Micromillimetre (Mkm) is a term used in microscopy, and signifies the one-thousandth part of a millimetre. Kilo is merely an abbreviation of the word kilogramme, and is used for convenience and brevity.

How would you convert metric weights or measures into those in ordinary use? Multiply the metric quantities by the corresponding equivalent. Ex. To convert—

Metres into inches, ...	multiply by	39.370
Litres into fluidounces, ...	" "	33.815
Cubic Centimetres into fluidounces, . .	" "	0.0338
" " " Imperial fluidounces	" "	0.0352
Grammes into grains, ...	" "	15.432
Decigrammes into grains, ...	" "	1.5432
Centigrammes " "	" "	.15432
Milligrammes " "	" "	.015432

How would you convert the weights and measures in ordinary use into metric weights and measures? Multiply the quantities by the corresponding metric equivalent. Ex. To convert—

Inches into metres, ...	multiply by	0.0254
Fluidounces into cubic centimetres,	" "	29.572
Grains into grammes, ...	" "	0.0648
Avoid. ounces into grammes, . .	" "	28.3495
Troy " " " . .	" "	31.1035

What is a Balance? An instrument for determining the relative weight of substances.

How many kinds of Balances are there? Five: 1. Single beam, equal arm. 2. Single beam, unequal arm. 3. Double beam, unequal arm. 4. Compound lever balances. 5. Torsion balances.

Describe the construction, requirements and tests of each. 1. SINGLE BEAM, Equal arm.—*Construction.*—A beam is suspended on a knife-edge, which divides it into equal arms; end knife-edges are placed at each end of the beam, on the same plane and at equal distances from the point of suspension, for supporting the pans which carry the substances to be weighed.

Requirements.—1. "When the beam is in a horizontal position, the centre of gravity should be slightly below the point of suspension, or central knife-edge, and perpendicular to it." (Remington.) 2. "The end knife-edges must be exactly equal distances from the central knife-edge; they must all be in the same plane, and the edges absolutely parallel to each other." (Remington.) 3. "The beam should be inflexible, but as light in weight as possible, and the knife-edges in fine balances should bear upon the agate planes." (Remington.)

Test.—1. Sensibility with unloaded pans: 1. Place the balance in position on a perfectly level counter or table; elevate the beam so that it is free to oscillate; when the balance comes to rest, place the smallest weight to which it is sensitive upon the right-hand pan, to which the balance should immediately respond. 2. Sensibility with loaded pans: Place the full weight the balance is designed to carry on the pans, then on one pan place the smallest weight, as before. The balance should respond in a decided manner. 3. Equality of arms: Load the pans to half their capacity, perfecting the equilibrium, if necessary, with a piece of tin-foil. Now reverse the weights, and if the equilibrium is still maintained, the arms of the beam are equal. 4. Parallelism in knife-edges: Moderately load and balance the pans. Now shift one of the larger weights in different positions on the edge of the pan, carefully noting any variation in equilibrium, if such occur. This variation indicates a want of parallelism in the knife edges.

2. SINGLE BEAM, UNEQUAL ARM.—*Construction.*—This can be seen by inspecting the well-known Fairbanks scales. It depends on the principle in physics, "The *power is to the weight or resistance in the inverse ratio of the arms of the lever.*" The longer arm of the beam is graduated for a movable weight, the use of which dispenses with small weights, which is a decided advantage.

3. DOUBLE BEAM, UNEQUAL ARM.—*Construction.*—Same as the above, but with two parallel beams. Employed for weighing liquids, etc., the outside beam being used to tare the bottle or jar.

4. Compound Lever Balances.—Well shown in Fairbanks' platform scales, used for druggists' counters and sometimes for prescription scales. Trömner has an excellent scale for weighing liquids on this principle.

5. Torsion Balances.—A compound beam is balanced and supported upon an immovable centre frame, upon which a flattened gold wire is stretched with powerful tension; the beam is prevented from slipping out of place, and the torsion is secured, by the gold wire being firmly fastened to the under side of the beam; upon the ends of the beam are fastened the movable frames which support the pans. There is a simple method of arresting the motion by moving the lever, and the delicacy of the balance is increased by placing a weight upon the index, whereby the centre of gravity is elevated. *Knife-edges are done away with entirely.*

How may Balances be protected? By enclosing them in glass cases with convenient sliding doors.

How are liquids measured? In graduated vessels; vessels of tinned copper, tinned iron, and enameled sheet-iron, called agate, are usually employed for quantities larger than one pint; but glass measures are preferable for quantities of one pint or less. The former are generally made larger at the bottom than the top; the latter are either conical, with apex at the bottom, or cylindrical, and graduated on the sides. It is better that the marking be on both sides of the graduate.

How would you test a glass graduate? Place it upon a perfectly level surface, then pour into it 455.7 grains distilled water at 15.6° C. (60° F.). This should measure one fluidounce; or, measure into the graduate 30 c.c. of water (29.57 c c.) for a fluidounce.

What is a graduated Pipette? A glass tube graduated on the side, with a constricted point. It is used by applying suction to the upper end, and holding the liquid in the tube by applying the finger to the upper end while reading off the contents.

What is a Meniscus, and for what is it used? Owing to capillary attraction, the top of the liquid in a graduated pipette presents a cup shape. This is called a *meniscus*. A line drawn through the bottom of the *meniscus* is usually selected as the reading point.

What is the size of a drop? Erroneously, a drop is supposed to be a minim; but though this may be approximately true when applied to water, it is not true in regard to any other liquid. Thick, viscous liquids produce large drops; heavy, mobile liquids small ones. A drop of syrup of acacia is five times as large as a drop of chloroform. The shape and surface from which the drop is poured also influences its size.

SPECIFIC GRAVITY.

What is Specific Gravity? The comparative weight of bodies of equal bulk. It is ascertained by weighing the bodies with an equal bulk of pure water at a given temperature and atmospheric pressure, which is taken as one.

How would you obtain the Specific Gravity of a body? To obtain the specific gravity of a body, it is only necessary to balance it with an equal bulk of the standard, and ascertain how many times the weight of the standard is contained in its weight. Ex. A fluidounce of water (standard) weighs 455.7 grains; a fluidounce of lime-water weighs 456.3

grains; 456.3 ÷ 455.7 = 1.0015, that is, the lime-water weighs 1.0015 times more than water, bulk for bulk. In other words, its specific gravity is 1.0015. A fluidounce of alcohol weighs 422.8; 422.8 ÷ 455.7 = 0.928, specific gravity.

What general rule may be given for finding Specific Gravity? Divide the weight of the body by the weight of an equal bulk of water; the quotient will be the specific gravity.

What method is usually adopted to ascertain the weight of the equal bulk of water in taking the Specific Gravity of solids? A solid body immersed in water will displace its own bulk; it is required to find out the weight of this equal bulk of water. This might be ascertained by immersing the body in a vessel of water already full, then saving and weighing the displaced water which runs over. But there is a better way of finding out. Archimedes filled his bath-tub too full of water, one day, and it overflowed when he got into it. This led him to experiment, and he found that when weighed in water he lost as much weight as the water he displaced weighed. It is only necessary, then, to weigh a body first in air, then in water, and note its loss of weight when weighed in the latter medium. This loss is evidently the weight of an equal bulk of water. By our rule, we divide the weight of the body by the weight of an equal bulk of water; and it follows that it is the same thing to say: divide the weight of the body by its loss of weight in water, for that loss is the weight of an equal bulk of water. The quotient will be the specific gravity.

How would you take the Specific Gravity of a body heavier than water? Four methods are used. *1st method:* Accurately weigh the substance and note the weight. Now suspend the body from the hook at the end of the scale-beam with a horse hair, so it shall hang a little above the scale-pan; next, place a small wooden bench in such a manner that it shall straddle the scale-pan, but not touch it; place a small beaker on the bench, partly filled with water, in which submerge the suspended body, noting the loss of weight by the use of proper weights on the opposite scale-pan; after which apply the rule already given. Ex. Weight of a piece of copper in the air, 805.5 grains; weight in water, 715.5 grains; loss of weight, 90 grains. 805.5 ÷ 90 = 8.95, sp. gr. *2d method:* With the Specific Gravity, bottle. Add 1000 to the weight of the substance in the air. Now drop it into a 1000-grain specific gravity bottle, fill the bottle with water and weigh again. Subtract the 2d sum from the 1st sum, and the difference is the loss of weight in water. Now apply the rule. Ex. A piece of aluminum wire weighs 100 grains in the air. 100 + 1000 = 1100. Dropped in a 1000-grain specific gravity bottle, and the bottle filled with water, the weight of both is 1062. Then 1100 — 1062 = 38 grains, the loss of weight in water. 100 ÷ 38 = 2.63, specific gravity. *3d method:* With the graduated tube. Drop the substance into a tube graduated so that each space shall indicate a grain or gramme of water, and note how much higher the liquid rises in the tube, which is the weight of an equal bulk of the substance. This known, apply the rule. *4th method:* By immersing the solid in a transparent liquid of the same density. Drop the solid in a liquid of sufficient density to float it, then reduce its density with water until the solid neither rises nor sinks, but swims indifferently. The specific gravity of the liquid and solid will now

be the same. Take out the solid and find the specific gravity of the liquid with the specific gravity bottle.

How would you proceed if the solid were soluble in water? Use oil or some other liquid in which the solid is not soluble, as though it were water, then, by the following proportion, find the loss of weight in water: as the specific gravity of oil is to the specific gravity of water, so is the loss of weight in oil to the loss of weight in water. Then apply the rule.

How would you take the Specific Gravity of a solid lighter than water? Force the substance under water by attaching a heavier body to it. First weigh both in the air, then both in water, and the difference will be the loss of both in water. A simple subtraction will give the loss of weight of one. Then apply the rule.

With what apparatus would you take the Specific Gravity of a liquid? A specific gravity bottle, hydrometer, or specific gravity beads.

How would you construct a Specific Gravity bottle? A bottle with a long, slim neck is counterpoised by an appropriate weight, and distilled water at the appropriate temperature, 15° C. (60° F.), poured in until it contains 1000 grains. The height reached by the water in the neck is then scratched thereon with a file, and is ready for use.

What are Specific Gravity beads? Little pear-shaped, hollow globes of glass, loaded at the apex, and arranged to float indifferently in liquids of the specific gravity for which they are gauged, but to sink or swim in liquids that are lighter or heavier than they are.

Give directions for using the Specific Gravity bottle for taking the Specific Gravity of Liquids. Counterpoise the bottle and fill it to the mark with the liquid to be examined. The number of grains the liquid weighs, properly pointed off decimally, is its specific gravity. A 1000-gr. specific gravity bottle will hold 1160 grains of hydrochloric acid. Point off decimally 1.160, which is the specific gravity of hydrochloric acid. A 1000-gr. specific gravity bottle will hold 750 grains of ether. Point off decimally 0.750, thus showing the relation to the specific gravity of water, 1.

If a bottle of any size is substituted for the 1000-gr. bottle, what equation will give the specific gravity? As the number of grains of water the bottle holds is to 1000 (the specific gravity of water), so is the number of grains of liquid it holds, to the specific gravity of the liquid.

Describe the Hydrometer. As now constructed, the hydrometer usually "consists of a glass tube loaded at the bottom with mercury or small shot, having a bulb blown in it just above the loaded end." The principle of its action depends upon the fact that a solid body floating in a liquid displaces a volume of liquid exactly equal to its own weight.

Into what two general classes may Hydrometers be divided? 1st, those for liquids heavier than water; 2d, those for liquids lighter than water. The first class are called by the French *Pèse-Acide*, or *Pèse-Sirop*, and the second class *Pèse-Esprit*.

What other class of Hydrometers is in use? Those intended to sink, by the addition of weights, to a given mark on the stem, and thus displace a constant volume.

What is a Baumé Hydrometer? The instrument devised by Baumé is peculiar only in so far as its system of graduation is concerned. This was made in the following manner: *1st, for liquids heavier than water*,

the instrument was loaded with sufficient mercury to sink it in water to a convenient point near the top, which was marked 0. It was then placed in a 15 per cent. salt solution, and the point at which it rested marked 15; the interspace between 0 and 15 was now marked off into 15 equal spaces, and the scale below extended by marking off similar spaces. *2d, for liquids lighter than water*, a 10 per cent. salt solution was used, and the instrument loaded to sink into it to a point just above the bulb, which was marked 0. It was then allowed to sink in water, and the point of rest marked 10. The interspace between 0 and 10 was now divided into 10 equal spaces, and the scale above extended by marking off equal spaces.

What is the objection to Baumé's Hydrometer? The graduations are entirely arbitrary, necessitating computation to determine the corresponding specific gravity.

What Hydrometer is rapidly taking its place? The Specific Gravity Hydrometer; the graduations upon the stem indicating at once the specific gravity.

Urinometer, *saccharometer*, elæometer (for fixed oils), and alcoholmeter, and hydrometers for the special purposes indicated by their names.

HEAT.

What is heat? Heat is molecular motion.

What is a Furnace? A species of stove for generating heat.

What are the elements of a furnace? The *air-flue*, *combustion-chamber* and *vent* or *chimney*.

What proportion should they bear to each other? The special object sought in constructing the furnace must determine the proportions these shall bear to each other.

What is the best fuel for generating heat? Anthracite Coal.

How much air is required to burn one pound of coal? Theoretically, 150 cubic feet; practically, twice that.

What liquids are used for fuel in pharmacy, and on what does their heating power depend? Alcohol, petroleum or coal oil, and benzine or gasoline. They all contain C and H (alcohol, 34 per cent. O in addition), on which their heating depends.*

What is Illuminating Gas? A mixture of carburetted hydrogen (CH_4), which is its principal constituent, with considerable hydrocarbons, hydrogen, carbon dioxide and monoxide, aqueous vapors and traces of oxygen and nitrogen.

How may it be fitted for heating purposes? By mixing it with air. This is done by admitting air below the flame, using special apparatus for this purpose.

Describe a Bunsen Burner. A brass tube, four inches high, with four large circular holes near the base, to admit the air, which may be regulated by a perforated brass ring which surrounds the tube, is supported by a metal pedestal, and connected with a gas fixture by a tube. The coal-gas admitted mixes with the air, and burns at the top of the tube with an intensely hot, colorless flame.

How would you measure heat? By the thermometer.

* For special apparatus for developing heat for pharmaceutical manipulations, see Remington's "Practice of Pharmacy."

Describe a Thermometer. A thermometer consists of a glass tube with capillary bore sealed at one end, and the other end terminating in a bulb. The bulb is filled with mercury or other fluid, which, being expanded by heat, rises in the tube and indicates the degree of heat, either on an index scratched on the tube itself, or marked on a piece of paper against which the tube is placed.

Describe the three scales for marking thermometric degrees now in use. The scales are, 1. Centigrade; 2. Fahrenheit, and 3. Réaumur. In the Centigrade scale, the freezing point of water is zero, the boiling point 100°, and the intervening space is divided into 100 equal parts called degrees. In the Fahrenheit scale, the freezing point of water is 32°, the boiling point 212, and the intervening space is divided into 180 equal parts called degrees. In the Réaumer scale, the freezing point is zero, and the boiling point 80.

What ratio do the three scales bear to each other, and how would you convert the scale of one into the other? Ratio : 5 : 9 : 4.

FORMULÆ FOR THE CONVERSION OF DEGREES OF ONE THERMOMETRIC SCALE INTO THOSE OF ANOTHER.—*Attfield.*

F. = Fahrenheit. C. = Centigrade. R. = Réaumur. D. = Observed Degree.

If above the freezing point of water (32° F.; 0° C.; 0° R.),	If below freezing, but above 0° F. (— 17.77° C.; — 14.22° R.),
F. into C., ... (D — 32) ÷ 9 × 5	F. into C., . . — (32 — D) ÷ 9 × 5
F. " R., ... (D — 32) ÷ 9 × 5	F. " R., . . — (32 — D) ÷ 9 × 4
C. " F., ... D ÷ 5 × 9 + 32	C. " F., ... 32 — (D ÷ 5 × 9)
R. " F., ... D ÷ 4 × 9 + 32	R. " F., ... 32 — (D ÷ 4 × 9)
If below 0° F. (— 17.77° C. — 14.22° R.),	For all degrees,
F. into C., . . . — (D + 32) ÷ 9 × 5	C. into R., ... D ÷ 5 × 4
F. " R., . . . — (D + 32) ÷ 9 × 4	R. " C., ... D ÷ 4 × 5
C. " F., . . . — (D ÷ 5 × 9) — 32	
R. " F., . . . — (D ÷ 4 × 9) — 32	

RULES.

1. To convert Centigrade degrees into those of Fahrenheit above 32, multiply by 1.8 and add 32.

2. To convert Fahrenheit degrees above 32 into those of Centigrade, subtract 32 and divide by 1.8.—*Remington.*

How would you select a thermometer? Choose one made of glass, thick enough to be strong, but thin enough to be delicate, with graduations marked on tube, which should be of equal diameter throughout, with flat or elliptical, perfectly uniform bore. It should be free from air, which may be tested by inverting the instrument and seeing that the mercury descends to the lowest part of the tube.

What is a blow-pipe, and how is it used? A slightly conical, gradually tapering metallic or glass tube, curved at the smaller end, and having a minute orifice at that end for producing a blast. When used, an unremitting current of air is forced through the tube from the mouth, by keeping the cheeks distended with air and constantly supplying fresh air from the lungs, as needed.

Describe the nature of the blow-pipe blast. 1st. It has an intense heat. 2d. When used with a luminous flame, the interior of the blow-pipe blast, owing to the carbon not being wholly oxidized, has the power of reducing oxides. It is, therefore, called the *reducing* flame. The outer part

of the blast has the opposite or oxidizing property, and is called the *oxidizing* flame.

What is the blow-pipe used for in Pharmacy? Used for bending and working glass, testing fusible chemical substances, in soldering, etc.

What is a Crucible, and for what is it used? A crucible is a cup-shaped vessel, intended to withstand a powerful heat. Clay, plumbago, porcelain, iron, silver and platinum are some of the materials employed for crucibles. Platinum ranks first, plumbago second, the Hessian crucible next, though quite inferior, then comes the more fragile porcelain and wedgewood crucibles, which must be gradually cooled, to prevent breakage.

What eight processes in Pharmacy require the application of high heat? 1. *Ignition.* 2. *Fusion.* 3. *Calcination.* 4. *Deflagration.* 5. *Carbonization.* 6. *Torrefaction.* 7. *Incineration.* 8. *Sublimation.*

Describe each of these processes. 1. *Ignition* consists in strongly heating solid or semi-solid substances to obtain a definite residue. Ex. The officinal quantitative tests for purified sulphide of antimony, phosphoric acid, etc.

2. *Fusion* is the process of liquefying solid bodies by heat. Ex. Melting of iron or lead, or of wax.

3. *Calcination* is the process of driving off volatile substances, such as gas or water, from inorganic matter, by heat without fusion. Ex. Magnesia, lime, etc., prepared by calcination.

4. *Deflagration* is the process of heating one inorganic substance with another capable of yielding oxygen (usually a nitrate or a chlorate); decomposition ensues, accompanied by a violent, noisy or sudden combustion. Ex. Salts of As and Sb made by this process.

5. *Carbonization* is the process of heating organic substances *without* the access of air, until they are *charred*. The volatile products are driven off, but combustion is prevented. Ex. Charcoal is made in this way.

6. *Torrefaction* is the process of roasting organic substances. The constituents are modified but not charred. Ex. The roasting of coffee. *Torrefied Rhubarb* is obtained in this way. It loses its cathartic properties by this process, but retains its properties as an astringent.

7. *Incineration* means the burning of organic substances to ashes in air. The ashes is the part sought. Ex. Determining the amount of fixed matter in organic substances by burning them and examining the ashes.

8. *Sublimation* is the process of distilling solid volatile substances from non-volatile substances. Ex. Camphor is separated from strips of wood from the camphor tree in this way.

What various forms of apparatus are used to modify and control heat? The water-bath, salt-water bath, sand-bath, oil-bath, glycerine-bath, etc.

Limit the range of the several forms of bath. The water-bath can only be used for temperatures below 100° C. (212° F.). Saturated salt solution boils at 108.4° C. (227.1° F.), which degree limits the range of the salt-water bath. Glycerine may be heated to 250° C. (480° F.) without much inconvenience from the Acrolein, which is produced when that substance is raised nearly to the boiling point. The oil-bath is designed to furnish a regulated temperature below 260° C. (500° F.), and the sand-bath may be used at any temperature.

Upon what theory is Steam used in pharmaceutical operations? Matter exists in three forms: *solid*, *liquid* and *gaseous*, depending upon the degree of distance between its molecules. Heat is but another name for molecular motion (possibly atomic motion also). Increase molecular motion, and molecular distance is increased to give room between the molecules for that motion. Cohesion holds molecules together. Heat, therefore, works against cohesion. If water is heated until its molecules are driven far apart, it becomes steam (water-gas), and its molecules are now in very rapid vibration. If brought into contact with a cool surface, that is, a surface of slower molecular vibration, it imparts its motion to that surface, and the steam is condensed—its motion is lost, and it returns to the condition of fluid again. But by imparting its heat (motion) to the surface with which it came in contact, this surface becomes heated. The molecular motion of the surface becomes as great as the steam when equilibrium is attained and the temperature of the surface remains constant. As hot steam can be transported long distances by appropriate pipes, it becomes a convenient means of heating surfaces at a distance from the fire, and the steam being under perfect control, the temperature may be regulated with great exactness.

In what two forms is steam used for heating? Steam without pressure, and steam under pressure, or superheated steam.

What advantage has the latter? Steam under pressure is hotter because more heat is required to raise water to the condition of a gas against increased pressure.

In what way may steam under pressure be used for evaporation? By means of jacketed kettles.*

How may the heat be increased in such kettles? By combining the kettle with a steam coil.

For what other purposes are steam coils used? For heating apartments, drying ovens, evaporating dishes placed upon them, and for boiling water, by placing a steam coil in the water.

OPERATIONS REQUIRING HEAT.

What is Vaporization? The operation of increasing molecular motion by heat until matter assumes the form of vapor or gas.

Explain what is meant by the various terms, Evaporation, Distillation, Desiccation, Exsiccation, Granulation, Sublimation. In the vaporization of liquids, when the object sought is the fixed part, the process is called *evaporation*, when it is the volatile part that is sought, it is called *distillation*. If solids are vaporized, when the fixed part is sought, the process is called *Desiccation*, *Exsiccation*, and when furnished in a granular condition, *Granulation;* but if the volatile part is sought, it is called *Sublimation*.

What is Ebullition, or Boiling? A violent agitation in a liquid produced when it is heated from the fluid to the gaseous condition. The heat acts first on that portion of liquid resting against the heated surface, converting a portion into steam, which rises in the form of bubbles, which break on the surface of the liquid.

* For various forms of jacketed kettles, boilers, etc., for using steam in pharmaceutical operations, see Remington's "Pharmacy."

What is meant by the boiling point of a liquid? The temperature at which it boils. Each liquid has its specific boiling point as well as its specific weight. Liquids evaporate more or less at all temperatures, hence there seems to be no specific *evaporating* points, but there is a specific point where ebullition commences.

What is meant by the tension of matter? The molecules of which matter is composed repel each other, but are held together by cohesion and atmospheric pressure. Matter is, therefore, said to exist in a state of tension. The repelling force may be heat; at any rate, by increasing heat, or molecular motion, the repelling force is increased. Heat, therefore, is a force working against cohesion and atmospheric pressure, to separate molecules apart.

How may advantage be taken of the knowledge of tension to increase the rapidity of evaporation? By removing the pressure of the atmosphere from a liquid and increasing its molecular motion, viz.: heating it, evaporation is hastened.

What important factor plays a part in the evaporation of a liquid in the open air? The degree of moisture already in the air.

In evaporating liquids at the boiling point, temperature, pressure, etc., being equal, what determines the rapidity of the evaporation? The amount of surface exposed to the heat.

What determines the rapidity of evaporation under like circumstances below the boiling point? The amount of surface exposed to the air.

How would you apply this knowledge? By selecting suitable vessels for evaporation, and employing various devices to increase the heating surface, or the surface exposed to the air, depending upon the method of evaporation chosen.

What is a Vacuum Pan? A covered evaporating pan, with an air pump, condenser, etc., for removing the pressure of the atmosphere while conducting the process of evaporation.

What is an evaporating chamber? A species of "fume-closet," built into a chimney-breast, provided with gas-burners, etc., for conducting evaporation.

How would you protect a vessel from unequal heating by the flame when evaporating by direct heat? By a piece of wire gauze between it and the flame.

How would you evaporate a liquid to a fixed weight? Use a tared dish, and weigh both dish and contents when required.

How would you evaporate to a fixed volume? Use a graduated evaporating dish, and evaporate to the required volume.

How would you mark the evaporating dish to determine the required volume? Dishes may be bought already graduated, or graduated in the laboratory, either by marking the dish on the inside or pasting a strip of paper to the inside, marked with the required measure. A strip of wood placed across the top of the dish, perforated in the middle for a glass thermometer, can be used for graduating purposes, by tying a string on the thermometer to indicate the desired level.

What is a Hood? A contrivance connected with a chimney to place over evaporating dishes, etc., to conduct away vapors.

What is a Grommet? A circular bit of rubber hose upon which a round-bottomed dish may be placed to keep it from turning over.

What is meant by Spontaneous Evaporation? The evaporation of a liquid at the ordinary temperature of the atmosphere.

What is Distillation? The operation of separating one liquid from another, or a liquid from a solid, by *vaporization* and *condensation*, the volatile part being the object sought.

About how much water is required to condense steam at 100° C. (212° F.)? About twenty-five times its weight of water, at 20° C. (68° F.).

Describe the two typical forms of apparatus used in distillation. 1st. The *alembic* consists of a *head* or *dome*, in which the vapors generated in the *body* or *cucurbit* are condensed and run into a gutter at the base of the dome, and are carried off by a pipe. The use of the alembic in its original form is nearly obsolete. 2d. The retort consists of a long-necked flask, with the neck bent at right angles with the body of the flask. When the flask has a *tubulure*, or orifice at the top of the body, for the purpose of introducing the liquid to be distilled, it is called a *tubulated* retort. Other materials, besides glass, are used for making retorts.

How would you select a retort? For very volatile liquids a deep retort is preferable. The bottom of the neck should form an acute angle with the body. The tubulure should be situated well back, to admit a funnel without striking the bottom of the neck. The neck should taper gradually, permitting the use of a rubber ring, to form a tight joint between it and the condenser, the ring being made tight by forcing it up the gradually tapering neck. The glass should neither be too thick nor too thin, well annealed, and free from scratches, bubbles and imperfections.

How would you improvise an ordinary flask for distillation? Select a flat-bottomed flask, with a wide mouth, to admit a large-sized rubber stopper containing a wide, bent tube, to act as a neck, a thermometer and a safety or changing tube. The joints are made tight by *luting* them.

What is a lute? Various pastes, which harden when dry, and serve to make joints vapor-proof, are called lutes. Flaxseed meal poured into boiling water and stirred into a paste, is generally used.

How may glass tubes be connected with each other? By rubber tubing, or pieces of bladder moistened and wrapped around the proposed joint, and tying with strong linen twine.

What are receivers? Glass vessels, usually globular in shape, for receiving distillates. Three kinds are used; plain, *tubulated* and *quilled*. The tubulure is to prevent explosions, and the quill to allow the distillate to escape, for the purpose of measuring it as it condenses.

What are Adapters? Tapering tubes of glass, used to connect retorts with receivers.

How would you charge a retort? A plain retort should be charged with a long-beaked funnel, reaching well down into the body of the retort. Place a funnel in the tubulure, to charge a tubulated retort.

How are retorts supported? By retort stands, of which there are several patterns.

What is meant by bumping, and how may it be prevented? Certain explosions occurring in a liquid when it is boiled. It may be prevented by placing some pieces of broken glass in the retort.

What is a Liebig's Condenser? Two long tubes, the smaller inside

the larger, and sufficient space between them to allow the free circulation of water, are kept in place by rubber rings between them at each end of the apparatus. The inside tube is longer, to allow it to be connected at one end with a retort, and the other end with a receiver. The apparatus is inclined at an angle on a stand, and when in use, cold water is circulated between the tubes, entering at an orifice situated at the lower end, and escaping at a similar orifice situated at the top, thus condensing the vapors passing through the inner tube.

What is a Still? Various forms of apparatus embracing the principles of the alembic and retort, either singly or combined, used for distillation, are called stills. When the neck of the retort is prolonged into a coil and immersed in water to condense the vapors, it is called a *worm*.

What is sublimation? The process of distilling volatile solids. The product is called a *sublimate*.

Describe the product: 1st. Cake sublimate; 2d. Powder sublimate. When the volatile product condenses at a temperature but slightly lower than the condensing point, the deposit is made slowly and a large cake of crystals is produced. But if the vapor is condensed rapidly in a cold temperature, a powder results. Retorts and hoods of various patterns are used for sublimation, or the vapor may be condensed in chambers specially arranged for the purpose.

What is meant by Desiccation? The operation of drying medicinal substances.

What are the three objects for drying medicinal substances? 1. To aid in preserving them. 2. To reduce their bulk. 3. To facilitate their comminution. The operation is effected by various forms of ovens and drying closets, described in works on pharmacy.

OPERATIONS NOT REQUIRING HEAT.

What is meant by Comminution? The process of tearing drugs to pieces or reducing them to powder.

Name some of the processes for comminuting drugs. Cutting, rasping, grating, chopping, contusing, rolling, stamping, grinding, powdering, triturating, levigating, elutriating, granulating, etc.

What instruments may be used for cutting, slicing or chopping? Pruning-knife, pruning shears, tobacco-knife, or herb-cutter.

What instrument for grating? Half-round rasp.

What for contusion? Iron pestle and mortar, or the pestle and mortar may be made of wood or marble.

What is meant by the terms Grinding and Pulverizing? Grinding means reducing substances to *coarse* particles. Pulverizing means reduction to *fine* particles.

What is a Drug Mill? A mill for comminuting drugs.

Into what four general divisions are drug mills divided? Burr-stone mills, roller-mills, chaser-mills and hand-mills.

Describe the principle of each. A burr-stone mill consists of two disks of stone, rubbing together, the approximating faces being cut in grooves, to afford grinding surfaces.

Roller-mills consist of rollers revolving in opposite directions, the dis-

tances between them being regulated by screws. They operate by crushing, or cutting and crushing, and the rollers are made smooth, or with corrugations, serrations, undulations or crenations, according to the nature of the drug which is to be operated on.

Chaser-mills consist of two heavy granite stones revolving on a circular granite base, surrounded by an iron curb. They operate by crushing and by the friction engendered by the outer edge of the stone traveling through a longer distance than the inner edge.

Hand-mills are divided into three classes, according to the arrangement of their grinding surfaces, which may be *vertical*, *horizontal* or *conical*. They are made of iron, with grinding plates of hardened iron or steel, and thumb-screws to regulate the distance between the grinding faces.

What is meant by Trituration? Rubbing substances to fine particles by means of a pestle and mortar.

Describe the Process. Give the pestle a circular motion with downward pressure. Commencing in the centre of the mortar, work outward in ever increasing circles till the side of the mortar is touched, then reverse the motion and decrease the size of the circles till the centre is reached.

How should a pestle fit its mortar? See that the pestle has as much bearing on the interior surface of the mortar as its size will permit, to secure as much triturating surface as possible.

Of what substances are pestles and mortars for trituration composed? Wedgewood, porcelain, and glass.

What is a Spatula? A flexible steel blade fixed in a handle, and used for various purposes in pharmacy. "In trituration they serve to loosen up the substance when it becomes packed upon the sides of the mortar." The best form of spatula is that known as the balance handle.

How may the fineness of powders be regulated? By sieves of various construction, with meshes of different sizes, as required. It is important that all portions of the sifted powder be thoroughly mixed, in order to secure uniform composition.

Powders are known as *very fine* (sieve with 80 meshes to the linear inch); *fine* (60 m. to l. i.); *moderately fine* (60 m. to l. i.); *moderately coarse* (40 m. to l. i.); *coarse* (20 m. to l. i.). These powders are also known by number, as Nos. 80, 60, 50, 40 and 20, respectively. Iron wire, brass wire, bolting cloth and horse hair are the materials usually chosen for sieves.

What is Levigation? "The produce of reducing substances to a state of minute division by triturating them after they have been made into paste with water or other liquid." A slab and muller is the apparatus used for this process. When this is constructed of porphyry, the process is termed porphyrization.

What is Elutriation? If an insoluble powder be suspended in water, the heavier particles will precipitate first. By decantation of the liquid, the finer portions may be separated. Prepared chalk is a familiar example. The process of making the pasty mass obtained by elutriation into little cones is called TROCHISCATION. A tinned iron cone, with a handle, is used for this purpose. The handle has a short leg in the centre, which is tapped gently on a slab, upon which the substance forced through the aperture at the bottom of the cone by the shock falls, in the form of a little

conical mass. Successive shocks are employed, and the resulting conical masses deposited in this manner on the slab soon dry, the moisture being absorbed by the slab.

What is meant by Pulverization by Intervention? The process of reducing substances to powder through the use of a foreign substance, from which the powder is subsequently freed by some simple method. Ex. Camphor may be powdered with the aid of a few drops of alcohol. The foreign substance is freed from the powder by subsequent evaporation.

SOLUTION.

What is solution? The permanent and complete incorporation of a solid or gaseous substance with a liquid. The product is called a *solution*, the liquid used, a solvent, and if the solvent will dissolve no more of the substance, the product is called a *saturated solution*.

What is the difference between simple and chemical solution? In simple solution, no change occurs in the chemical structure of the dissolved substance (sugar in water); but in chemical solution the reverse is the case. Ex. The officinal solution of nitrate of mercury.

How may solution of solids be facilitated? By pulverizing the substance the extent of surface exposed to the solvent is increased, and by agitation the frequency of the contact is augmented, thus favoring the rapidity of solution. Heat, by causing convection currents in the liquid, facilitates solution, and as heat works against cohesion, it increases the solubility of the substance.

May saturated solutions be used as solvents? Yes; a liquid saturated with one substance is still a solvent for another substance.

What effect has solution upon temperature? Simple solution lowers temperature; chemical solution raises temperature.

What is the best manner of effecting the solution of a solid? Crush the substance in a mortar with the pestle, then pour on the solvent, continually stirring the mixture.

What is meant by Circulatory solution? If the substance be placed in a bag and suspended in the solvent, a current will be engendered by the sinking of the dissolved portion from the bag, its place being supplied by fresh portions of the solvent.

What solvents are used in pharmacy? Water, first in importance, then Alcohol, Glycerin, Ether, Benzine, Chloroform, Bisulphide of Carbon, Acid, and Oils, take their respective rank as solvents.

How would you effect the solution of a gas in water? Apparatus is so arranged that the gas first passes through a wash-bottle, by which it is purified, and then allowed to bubble up through the solvent, which absorbs a portion of it during the passage.

SEPARATION OF FLUIDS FROM SOLIDS.

Name some of the processes for separating fluids from solids. Lotion, Decantation, Colation, Filtration, Clarification, Expression, Percolation, etc.

What is meant by Lotion or Displacement washing? The pro-

cess of separating soluble matter from a solid, by pouring a liquid upon it, which will dissolve and wash out the soluble portion. Ex. The washing of a precipitate in a funnel, by means of a Spritz bottle.

Various automatic apparatus for continuing washing are described in works on pharmacy.

What is Decantation? Separating a liquid from a solid, by pouring it off. This is sometimes better effected by a siphon

Describe a Siphon. A siphon is an inverted U tube, with one leg longer than the other. It is first filled with the liquid, and the shorter arm immersed in the liquid contained in the vessel, and a current established in this way: The column of liquid in the shorter arm is overbalanced by the column in the longer arm, thus causing a current to flow from the shorter to the longer arm, the shorter arm drawing a fresh supply from the vessel, which is thus finally emptied.

What is meant by Colation, or Straining? The process of separating a solid from a fluid, by pouring the mixture upon a cloth or porous substance which will permit the fluid to pass through, but will retain the solid.

What material is used for constructing Strainers? Gauze, Muslin, Flannel, Felt, etc.

What is meant by Filtration? The process of separating liquids from solids, with the view of obtaining the liquids in a transparent condition. *Filters* are made of paper, paper pulp, sand, asbestos, ground glass, charcoal, porous stone, etc.

Into what two general classes are paper filters divided? Plain and plaited. Plain filters are used for retaining and washing precipitates; plaited filters for ordinary filtering operations.

How are paper filters supported? In funnels.

What method is used for producing rapid filtration? Various methods are used, such as suction with the mouth, or by a column of falling water, to produce a partial vacuum beneath the filter, and thus hasten the process by increasing atmospheric pressure.

What is meant by Clarification? The process of separating from liquids, without the use of strainers or filters, solid substances which interfere with their transparency.

Describe the eight principal methods of Clarification.

1. *By the Application of Heat.* Heat, by diminishing the specific gravity of viscid liquids, permits the precipitation of the heavier particles, the lighter ones rising to the top. Boiling facilitates the separation, as the minute bubbles of steam adhere to the particles, and rise with them to form scum, which may be skimmed off.

2. *By Increasing the Fluidity of the Liquid.* This may be done by diluting it with water. Owing to the diminished specific gravity the heavier particles sink, and the liquid may then be decanted.

3. *Through the use of Albumen.* If albumen be added to the turbid liquid, and heat applied, on coagulating it will envelop the particles, and rise to the top with them. Skimming will remove the scum.

4. *Through the use of Gelatin.* Gelatin will form with tannin an insoluble compound, and where cloudiness is due to the presence of tannin, will clarify the liquid in this way.

5. *Through the use of Milk.* Acids will precipitate the casein of milk. It is used in sour wines, etc., the precipitated casein carrying with it the insoluble particles.

6. *Through the use of Paper Pulp.* Agitate the liquid with the pulp and let it stand till clear; or throw the whole on a muslin strainer; the pulp will form an excellent filtering medium by partially closing the meshes of the linen.

7. *By Fermentation.* Many substances soluble in the natural juices of plants are insoluble in the dilute alcoholic solutions resulting when these juices are fermented and subside as deposits.

8. *By subsidence through long standing.* The deposit formed is called a *sediment.*

What is the difference between a Sediment and a Precipitate? "Sediment is solid matter separated merely by the action of gravity from a liquid in which it has been suspended. A precipitate, on the other hand, is solid matter separated from a solution by heat, light or chemical action."

What is Decoloration? The process of depriving liquids or solids in solution of color, by the use of animal charcoal.

How would you separate Immiscible Liquids? By the use of a pipette, a glass syringe, a separating funnel or a Florentine receiver. A funnel with a stop-cock to stop the flow as soon as the heavier liquid has all passed through, is called a separating funnel. A Florentine receiver, used in the distillation of volatile oils, differs from an ordinary receiver, in having an overflow arranged to permit the escape of the condensed water while retaining the volatile oil.

What is meant by Precipitation? "The process of spreading solid particles from a solution by the action of heat, light or chemical substances." The solid particles separated is called the *precipitate*, the precipitate produced a *precipitant*, and the liquid remaining *supernatant liquid.* A precipitate may either fall or rise to the top of the supernatant liquid. The physical characteristics of precipitates are described by the words *curdy*, *granular*, *flocculent*, *gelatinous*, crystalline, bulky, etc. A *magma* is a thick, tenacious precipitate. Precipitation by heat is illustrated by the coagulation and precipitation of albumen when albuminous fluids are heated; and the precipitation of silver salts by light illustrates precipitation by light; and precipitation by chemical reaction occurs in a large number of instances when making officinal chemical salts.

What are the objects of Precipitation? 1st. A method of obtaining substances in the form of powder. 2. A method of purification. 3. A method of testing chemicals. 4. A method of separating chemical substances.

Vessels of glass called precipitating jars are made. They are larger at the bottom than the top. Hot, dense solutions usually produce heavy precipitates, and the reverse is the case when dilute solutions are employed. Precipitates may be collected in a funnel on filtering paper or on strainers.

CRYSTALLIZATION.

What is Crystallization? The process of placing substances under the most favorable circumstances for them to assume certain inherent geo-

metrical forms called *crystals*. Substances that will not crystallize are called *amorphous*. *Crystallography* is that department of knowledge devoted to crystals. The objects of crystallization are to increase the purity and beauty of chemicals.

1. MEANING OF TERMS.

Faces—the planes bounding a crystal.

Edge—the intersection of two contiguous surfaces.

Angle—the intersection of three or more faces.

Perfect crystal—a crystal in which the faces, edges or angles have equal faces, edges or angles opposite to them, and if the middle point of the opposite faces or edges, or the opposite angles be joined by straight lines, the point at which these lines intersect will be the centre of the crystal.

Axes—the lines drawn through the centre of crystals.

Dimorphous, *trimorphous*, *polymorphous*, etc.—when the same body crystallizes in two or more forms belonging to different systems.

Isomorphous—when *different* substances crystallize in the same form.

Prismatic—crystals extended principally in the direction of their longer axes.

Tabular—crystals with flat planes.

Laminæ—crystals in the form of thin plates.

Acicular—needle-shaped.

Orthometric—those in which the three axes intersect at right angles.

Clinometric—those in which the axes intersect at oblique angles.

2. SYSTEMS.

Six different systems of crystallization are recognized. The word systems is used because "every crystallizable body assumes its own characteristic form or some form directly derived from it by a single law," so that several forms may belong to the same system.

I. *Monometric* or *Regular*.—The angles of equal length intersecting at right angles.

II. *Dimetric* or *Quadratic*.—Three axes, two equal, the other different in length, all intersecting at right angles.

III. *Trimetric* or *Rhombic*.—Three axes of unusual length intersecting at right angles.

IV. *Hexagonal* or *Rhombohedric*.—Four axes, three of equal length, in the same plane, and inclined to one another at an angle of 60°. Fourth axis, different length, and intersects the planes of the other three at right angles.

V. *Monoclinic* or *Oblique Prismatic*.—Three axes of unequal length; two obliquely inclined to each other, the other axis forming right angles with these two.

VI. *Triclinic* or *Doubly-Oblique Prismatic*.—Three axes of unequal length, all obliquely inclined to each other.

What is meant by Cleavage? The tendency of crystals to split in one direction more than another.

By what methods would you obtain crystals? 1. By fusion and partial cooling (sulphur, camphor, etc.). 2. Sublimation (corrosive sublimate). 3. Deposition from hot, supersaturated solutions on cooling.

4. Deposition during evaporation. 5. Galvanism (deposited while current is passing through solution). 6. Precipitation. 7. By adding a solid substance having a strong affinity for water. (If $CaCl_2$ be added to a solution of NaCl, the latter will crystallize out.)

What is meant by Water of Crystallization? In the act of crystallizing, many substances combine with water. This is known as water of crystallization. The amount raises in the same crystal under different circumstances. When crystals lose their water of crystallization, and form a white powder on their surfaces, they are said to *effloresce*. Crystals that absorb water from the air are said to be *hygroscopic*. The act is called *deliquescence*.

What is meant by Mother liquor? The liquid remaining after the crystals have formed.

What is Dialysis? The separation of crystallizable from non-crystallizable substances by osmosis.

What is a Dialyzer? A vessel with a parchment head, like a drumhead, at one end, into which the substances to be separated are placed in the form of solution. This is floated on distilled water, and by osmosis the crystallizable substance transudes through the membrane into the water below, leaving the non-crystallizable substance behind.

Crystalloids.—Crystallizable substances. Ex., sugar, salt, chemical substances.

Colloids.—Non-crystallizable substances—glue, gum, starch, dextrine, etc.

Diffusate.—The impregnated distilled water.

What is Maceration? Soaking a drug in a solvent until the soluble portions are dissolved.

What is Expression? The process of *forcibly* separating liquids from solids.

Name the six mechanical principles employed in constructing presses. 1. Spiral Twist Press. 2. Screw Press. 3. Roller Press. 4. Wedge Press. 5. Lever Press. 6. Hydraulic Press. (For full description of these presses, see Remington's "Pharmacy.")

PERCOLATION.

What is Percolation? "Percolation is the process whereby a powder contained in a suitable vessel is deprived of its soluble constituents by the descent of a solvent through it." (Remington.)

By what other name is it called? Displacement.

Give a familiar example. The percolation of water through wood ashes, by which it is exhausted of its potash, etc., the solution being known as lye.

What is the use of this process in Pharmacy? It is used for extracting the virtues of drugs, in the preparation of tinctures, fluid extracts, etc.

Describe a Percolator. A Percolator is a cylindrical vessel with a porous diaphragm below, into which the drug, in the form of a powder, is introduced, and its soluble portions extracted by the descent of a solvent through it.

Describe the rationale of the process. The solvent, which is poured

on the top of the powder, in passing downward exercises its solvent power on the successive layers of the powder until saturated, and is impelled downward by the combined force of its own gravity and that of the column of liquid above, minus the capillary force with which the powder tends to retain it.

What is a Menstruum? The solvent is known technically by this name.

What is a Percolate? The liquid coming from the Percolator, impregnated with the soluble principles of the drug.

Why is Percolation also called the process of Displacement? Because it was first observed that ether, poured on powdered bitter-almonds, displaced the fixed oil which it contains without materially mixing with it.

Describe the condition in which the soluble principles exist in the powdered drug, and the effect of the solvent upon them. The soluble principles in the powdered drug exist in a hard and dry condition, and are generally contained in cells which are more or less disintegrated in grinding. The solvent takes up first the principle liberated by grinding, and afterwards permeates the cells.

Why is it that each succeeding portion of percolate is less highly colored and less active than the one preceding it? Because the first portion of menstruum, in its descent through the powder, has the first opportunity to come in contact with the largest portions of the soluble principles, which are to be found in the finer dust scattered through the powder, and in the thoroughly disintegrated particles, which offer but slight resistance to the passage of the menstruum.

What are the directions of the U. S. P. upon Percolation? The process of percolation, or displacement, directed in this Pharmacopœia, consists in subjecting a substance, in powder, contained in a vessel called a percolator, to the solvent action of successive proportions of menstruum in such a manner that the liquid, as it traverses the powder in its descent to the recipient, shall be charged with the soluble portion of it, and pass from the percolator free from insoluble matter.

When the process is successfully conducted, the first portion of the liquid, or percolate, passing through the percolator will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion of the percolate will be destitute of color, odor and taste, other than that possessed by the menstruum itself.

The percolator most suitable for the quantities contemplated by this Pharmacopœia, should be nearly cylindrical, or slightly conical, with a funnel shaped termination at the smaller end. The neck of this funnel-end should be rather short, and should gradually and regularly become narrower toward the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it from within, until the end of the cork is flush with its outer edge. The glass tube, which must not protrude above the inner surface of the cork, should extend from one and one-eighth to one and one-half inch (3 to 4 centimetres) beyond the outer surface of the cork, and should be provided with a closely-fitting, narrow tube, at least one-fourth longer than the percolator itself, and ending in

another short glass tube, whereby the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum in the percolator, a rubber band holding it in position.

The dimensions of such a percolator, conveniently holding five hundred grammes of powdered material, are preferably as follows: Length of body, fourteen inches (36 centimetres); length of neck, two inches (5 centimetres); internal diameter at top, four inches (10 centimetres); internal diameter at beginning of funnel-shape end, two and one-half inches (6.5 centimetres); internal diameter of the neck, one-half inch (12 millimetres); gradually reduced at the end to two fifths of an inch (10 millimetres). It is best constructed of glass, but, unless so directed, may be constructed of different material.

The percolator is prepared for percolation by gently pressing a small tuft of cotton into the space of the neck above the cork, and a small layer of clean and dry sand is then poured upon the surface of the cotton to hold it in its place.

The powdered substance to be percolated (which must be uniformly of the fineness directed in the formula, and should be perfectly air-dry before it is weighed), is put in a basin, the specified quantity of menstruum is poured on, and it is thoroughly stirred with a spatula or other suitable instrument, until it appears uniformly moistened. The moist powder is then passed through a coarse sieve—No. 40 powders, and those which are finer, requiring a No. 20 sieve, whilst No. 30 powders require a No. 15 sieve for this purpose. Powders of a less degree of fineness usually do not require this additional treatment after the moistening. The moist powder is now transferred to a sheet of thick paper, and the whole quantity poured from it to the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from fifteen minutes to several hours, unless otherwise directed; after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum; strongly alcoholic menstrua, as a rule, permitting firmer packing of the powder than the weaker. The percolator is now placed in position for percolation, and the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately-fitting disk of filtering paper or other suitable material, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions are accurately observed, the menstruum will penetrate the powder equally until it has passed into the rubber tube and has reached, in this, the height corresponding to its level in the percolator, which is now closely covered to prevent evaporation, and the apparatus allowed to stand at rest for the time specified in the formula.

To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for the quantity of liquid to be percolated, if the percolate is to be measured, or of a tared bottle, if the percolate is to be weighed; and by raising or lowering this recipient, the rapidity of percolation may be increased or lessened, as may be desirable, observing, however, that the rate of percolation, unless the quantity of material taken in operation is largely in excess of the Pharmacopœial quantities, shall not exceed the limit of ten to thirty drops in a

minute. A layer of menstruum must constantly be maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate obtained. This is conveniently accomplished, if the space above the powder will admit it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may dip beneath the surface of the liquid, the bottle being of such shape that its shoulder will serve as a cover for the percolator.

What is the best Percolator for common use? An ordinary glass funnel.

What is the objection to the glass funnel? It is too broad for use in percolating drugs for fluid extracts, when the quantity of drug is large in proportion to the quantity of menstruum.

What is the desirable shape for making this class of preparations? A tall, narrow Percolator.

Why? Because it is desirable that the menstruum should traverse a higher column of powder.

What is gained by this? 1st. Every drop of menstruum is economically applied; 2d, the rate of flow is diminished; 3d, the percolate becomes saturated more rapidly; 4th, the operation is, therefore, more easily controlled.

What general rule may be given for selecting percolators? For making fluid extracts, a tall, straight percolator should be selected; for making a strong tincture, the percolator should be slightly bell-shaped and wider; for making weak fluid extracts, use a funnel.

How would you limit these rules? The character of the drug influences the limit. Those containing a large amount of soluble matter, like kino, cannot be percolated in a tall, narrow funnel, because the percolate would soon become too dense to descend.

What influences the degree of comminution proper for each substance? It depends, 1st, upon the physical structure of the drug; 2d, the ease with which the menstruum dissolves the desired constituents; 3d, the length of time required to exhaust the powder; 4th, the relative proportion of menstruum to drug.

Why does the Pharmacopœia direct that the drug shall be poured through a coarse sieve after moistening? To render it uniform.

Why should the powder be moistened? 1st, a moist powder, like a moist sponge, greedily absorbs moisture, but a dry powder, like a dry sponge, repels attempts to moisten it; 2d, dry powders have a tendency to swell when moistened, which, owing to the pressure of the particles against each other and the sides of the percolator, prevent menstrua from penetrating them.

State the exceptions to the rule for moistening powders. Powders should not be moistened, 1st, when the addition of the menstruum would produce lumping, owing to the adhesive nature of the drug; 2d, when the moistened powder would offer too little resistance to the passage of the menstruum; 3d, those in which the menstruum is too volatile or too inflammable to render moistening desirable or safe. The cold percolation of sugar in making syrups illustrates the first; the preparation of oleoresins with ether illustrates the second and third.

Of what should the porous diaphragm be composed? Porous cotton, a deeply notched cork, or a perforated plug of cork or wood.

The porous diaphragm should be covered with clean sand, or a disk of scored filter paper, except when absorbent cotton is used. *Always* moisten the porous diaphragm with a *portion of the menstruum* before packing the percolator.

How should a percolator be packed? It should be packed in layers, each succeeding layer being packed according to the directions, "moderately" or "firmly," as the case may be, care being taken to use the same degree of pressure with each layer.

How would you test the correctness of the packing? By the descent of the menstruum, which should descend slowly and uniformly.

What general rule is given in relation to the degree of pressure to use in packing percolators? Porous, spongy drugs, and menstruum largely aqueous, require moderate packing. If a strongly alcoholic menstruum is directed, pack firmly.

How would you add the menstruum? Cover the top of the powder with a sheet of scored filter paper, place a weight upon it to keep it in place, and add the menstruum in divided portions, care being taken to follow with the succeeding portion before the first one has entirely disappeared, to prevent fissures forming in the powder, and the leaking of the menstruum through the fissures.

Why does the Pharmacopœia direct previous maceration of the powder before percolation? Because most drugs are not easily extracted by the menstruum, owing to the toughness of the powder, or nature of the desired principles, and maceration secures contact with the solvent for a longer time.

How is this maceration best effected? By introducing the moistened drug loosely into the percolator, and covering it closely, to prevent loss by evaporation.

How can it be determined if the drug is exhausted? Only by knowing beforehand what the active principles of the drug are, and testing the percolate, until they are no longer contained therein.

For example: The absence of bitterness in the percolate, from nux vomica, opium, and cinchona, indicate that the bitter alkaloids, to which their activities are due, have been thoroughly extracted from the drug; the absence of color in the percolate of cochineal and saffron, indicates that the desired coloring matters have been exhausted from the drugs, and the absence of astringency in the percolate, of drugs whose activities are due to tannic acid, indicate that it has been completely extracted.

What is the best menstruum for extracting a drug? The best menstruum for extracting a drug is one that will deprive it of its active and desirable principles, and leave in the residue those principles which are either inert or objectionable.

What other important points are to be taken into consideration in choosing a menstruum? A menstruum should always be chosen exactly adapted to the characteristics of the drug, and which will cause the retention of the soluble principles in a permanent form under the varying conditions of climate, and at the same time permit exposure to light, heat and air, without injury.

How can this be determined? Only by experiment.

Can it be accurately predetermined what amount of menstruum a powder will absorb and retain after percolation ceases? It cannot. The amount varies according to the nature of the drug employed, sometimes as much as eight to twenty per cent.

What great advantages does percolation have over maceration in respect to the character of liquid left in the residue? Maceration leaves a finished tincture in the residue; in percolation it is merely menstruum, the active portions of the drug having been dissolved in the preceding percolate.

How can absorbed menstrua be recovered? By distillation, or by treating the residue, first with weak alcohol, then with water.

When water causes a swelling of the substance and stops percolation, what expedients may be resorted to? Mix the residue with clean sawdust, rice chaff, or other inert dry substances, then percolate with water.

How may recovered distilled alcohol be purified? By treating it with permanganate of potassium (12 grains to the gallon), letting it stand a few days, then decanting or filtering.

In conducting the operation of Percolation, how would you control the flow of the Percolate? By the amount of pressure in packing; by raising or lowering the receiver containing the nozzle of the delivery tube, as directed by the U. S. P.; by using a stop-cock (objectionable); or by adopting one of the several forms of percolators devised for that purpose.

Mention some of the special percolators devised as improvements on the ordinary cylindrical and conical percolators, and the principles upon which they are founded. 1. Drusse's glass percolator. In this percolator evaporation is prevented by means of a ground-glass cover. The flow of the percolate is checked by screwing in the cover; should it flow too slowly, a piece of twine between the cover and the side will permit the necessary atmospheric pressure.

2. Squibb's Well-tube Percolator. In this percolator a large glass tube, called a well-tube, is placed in the centre of a stone-ware crock and slightly raised from the bottom by absorbent cotton; around it is packed the substance to be percolated, the menstruum is poured on the powder, trickles through and rises in the well, from which it is siphoned.

3. Double-tube Percolator. An ordinary percolator is used. In it is placed a well-tube, with a smaller tube telescoped therein, the end of the latter projecting for a few inches below the percolator, through a tightly-fitting cork. The well-tube rests on absorbent cotton. The menstruum percolates through the powder, permeates the cotton, and rises in the well-tube to the top of the smaller tube therein, over which it runs into the tube and out, being received in a vessel below. The height of the percolate in the well-tube, and consequently the rapidity of the flow, is controlled by raising or lowering the inner tube.

4. Suspended Percolator (Hance Bros. & White). This percolator is so arranged, being suspended by trunnions from a beam, that it can be readily turned upside down and emptied of its contents. It is suitable for large operations.

How would you support a Percolator? Several methods are in use: 1st, the ordinary retort stand (flimsy); 2d, Remington's Percolating Stand: this instrument consists of two parallel shelves, one above the other; each shelf consists of two parallel strips having slots down the centre, fastened to which, by thumb-screws working in the slots, are cross-pieces, having their inside edges hollowed out to receive the percolator. The cross-pieces may be slid either way to enlarge or reduce the space between them so as to fit percolators of all sizes. This excellent apparatus is suspended from the wall by brackets. The advantage is that it enables all percolating and filtering operations to be carried on with convenience in one place, thus saving time and labor.

3. Shinn's Percolating Closet consists of adjustable retort rings sliding up and down on gas-pipe supports, with conveniently arranged shelves, all enclosed in a convenient closet.

What kind of Receiving Bottles should be used for the percolate? Wide-mouth bottles are preferred. Where special accuracy is required, use a flask with a double mark on the neck. Bottles may be graduated by pasting a paper slip on the side, pouring in accurately measured quantities of water, carefully marking the height at each addition. A strip of adhesive plaster answers an excellent purpose.

What is meant by Repercolation? Repercolation is a process introduced by Dr. Squibb, and consists in "the successive application of the same percolating menstruum to fresh supplies of the substances to be percolated."

What are its advantages? By passing the weaker portions of the percolate through fresh portions of drug, it becomes thoroughly saturated. In this way a portion of the percolate will do work as menstruum, resulting in the saving of menstruum.

What is Fractional Percolation? A term used to define percolation when applied to two successive portions of powder. (Principle identical with repercolation.)

PART II.

THE FORMS OF PHARMACEUTICAL PREPARATIONS DIRECTED BY THE UNITED STATES PHARMACOPŒIA.

CLASSIFICATION OF OFFICINAL PREPARATIONS.

LIQUIDS. (*Remington.*) SOLIDS.

Made without percolation or maceration.	Made by percolation or maceration.	Made by percolation or maceration.	Made without percolation or maceration.
AQUEOUS SOLUTIONS.	AQUEOUS LIQUIDS.	Extracts,	Powders.
Waters,	Infusions,	Abstracts,	Triturations,
Solutions.	Decoctions.	Resins.	Masses,
			Confections,
	ALCOHOLIC LIQUIDS.		Pills.
AQUEOUS SOLUTIONS CONTAINING SWEET OR VISCID SUBSTANCES.	Tinctures,		Troches,
	Wines,		*Cerates,*
	Fluid Extracts,		*Ointments,*
Syrups,			*Plasters,*
Honeys,	ETHEREAL LIQUIDS.		*Papers,*
Mucilages,	Oleoresins.		*Suppositories.*
Mixtures,			
Glycerites,	ACETOUS LIQUIDS.		
	Vinegars,		
ALCOHOLIC SOLUTIONS.			
Spirits,			
Elixirs.			
ETHEREAL SOLUTIONS.			
Collodions.			
OLEAGINOUS SOLUTIONS.			
Liniments,			
Oleates.			

Roman type, internal use. Italic type, external use.

LIQUIDS.

AQUEOUS SOLUTIONS.

AQUÆ—WATERS.

What is an Aqua, or Water? An aqueous solution of a volatile substance.

How many Officinal Waters are there? Fourteen.

Waters are prepared by five methods: 1. Solution in cold water. 2. Solution in hot water. 3. Filtration through an impregnated powder. 4. Percolation through impregnated absorbent cotton. 5. Distillation.

FOUR CLASSES.

1. SIMPLE SOLUTION—(2). *Aqua Amygdalæ Amaræ* (0.1 per cent. oil bitter almonds), *Aqua Creasoti* (1 per cent. creasote).

2. BY PASSING GASES THROUGH WATER—(3). *Aqua Ammoniæ* (10 per cent. gas), *Ammoniæ Fortior* (28 per cent. gas), *Chlori* (0.4 per cent. gas).

3. PERCOLATION THROUGH IMPREGNATED COTTON—(6). *Aqua Anisi* (0.2 per cent. oil), *Camphoræ* (0.8 camphor in alcohol), *Cinnamomi, Fœniculi, Mentha Piperitæ, Menthæ Viridis* (each 0.2 per cent. volatile oil).

4. DISTILLATION—(3). *Aqua Aurantii Florum* (40 per cent. fresh flowers), *Destillata* (800 parts from 1000 of water), *Rosæ* (40 per cent. Pale Rose).

Class three may also be made by impregnating a powder (magnesium carbonate) with the substance, and filtering the water through it.

LIQUORES—SOLUTIONS.

What is a Liquor, or Solution? This class includes all aqueous solutions of non-volatile substances, except those naturally classed distinctively as syrups, infusions and decoctions.

There are twenty-six officinal liquors. Three classes:—

1. SIMPLE SOLUTIONS—(11). *Liquor Acidi Arseniosi* (1 per cent. As_2O_3, 2 per cent. HCl); *Arsenii et Hydrargyri Iodidi* (1 per cent. each); *Calcis* (saturated Ca2HO); *Ferri et Quininæ Citratis* (32.5 per cent. Cit. Fe et Am, 6 per cent. Quin., 14 per cent. Cit. Acid, 15 per cent. Alcohol and Water); *Iodi Compositus* (5 per cent. I, 10 per cent. KI); *Pepsini* (4 per cent. sac. pep., 1.2 per cent. HCl. 40 per cent. Glycerin, and Water); *Plumbi Subacetatis Dilutus* (3 per cent. Sol. Subac. Lead); *Potassæ* (5.6 per cent. Potassa, 2d formula), *Sodæ* (5.6 per cent. Soda, 2d formula); *Sodii Arseniatis* (1 per cent. Sod. Arseniatis); *Sodii Silicatis* (nearly saturated).

2. CHEMICAL SOLUTIONS—(Aqueous)—(16). *Liquor Ammonii Acetatis* (Dil. $HC_2H_3O_2$ + ammonium carbonate); *Ferri Acetatis* (Ferric Hydrate, glacial acetic acid, water—33 per cent. Ferric Acetate); Ferri Chloridi (Iron, HCl,HNO_3, and Water—37.8 per cent. Ferric Chloride); *Ferri Citratis* (Ferric Hydrate, Citric Acid, Water—43 to 44 per cent. scaled salt); *Ferri Nitratis* (Ferric Hydrate, HNO_3, Water—6 per cent. Ferric Nitrate); *Ferri Subsulphatis* (Ferrous Sulphate, H_2SO_4,HNO_3, Water—43.7 per cent. salt); *Ferri Tersulphatis* (Ferrous Sulph., H_2SO_4,HNO_3, Water—28.7 per cent. salt); *Hydrargyri Nitratis* (40 per cent. Hg red ox., 45 per cent. HNO_3, Water—50 per cent. (about) Mercuric Nitrate); *Magnesii Citratis* (Mg Carb., Cit. Acid, Syrup of Cit. Acid, $KHCO_3$, Water); *Plumbi Subacetatis* (Pb acet., Pb ox., Water—25 per cent. (about) Subacetate of Lead); *Potassæ* ($KHCO_3$, Lime-water—5 per cent. (about) Potassa); *Potassii Citratis* ($KHCO_3$, Cit. Acid, Water—9 per cent. (about) Potas. Cit.); *Potassi Arsenitis* (1 per cent. Arsenic, 1 per cent. $KHCO_3$, 3 per cent. Tr. Lav. Comp.); *Sodæ* (Na_2CO_3, Lime-water—5 per cent. (about NaHO); *Sodæ Chloratæ* (Na_2CO_3, Chlor. Lime-water—at least 2 per cent. avail. Cl); *Zinci Chloridi* (Zinc, HNO_3, Precip. Carb. Zn,HCl, Water—50 per cent. (about) Zn Chloride),

3. SOLUTION IN CHLOROFORM—(1). *Liquor Gutta-Perchæ* (9 per cent. G. P., 10 per cent. Pb Carb.).

AQUEOUS SOLUTIONS CONTAINING SWEET OR VISCID SUBSTANCES.

SYRUPI—SYRUPS.

What is a Syrup? A concentrated solution of sugar in water or aqueous liquids.

There are three kinds of syrups:—

1. SYRUP, OR SIMPLE SYRUP.—Sugar and water.
2. MEDICATED SYRUP.—Syrup containing various medicinal substances.
3. FLAVORED SYRUP.—Syrup used as a flavor only.

What is Sugar? Sugar is in white, dry, hard, distinctly crystalline granules, permanent in the air, odorless, having a purely sweet taste, and a neutral reaction. Commercially known as "granulated sugar."

Name the four officinal methods for preparing Syrups. 1. *Solution with heat.* 2. *Simple addition.* 3. *Agitation without heat.* 4. *Digestion or maceration.*

Syrups may often be prepared advantageously by *Percolation.* (See Remington's "Practice of Pharmacy.")

There are thirty-four syrups (four classes):—

1. SOLUTION WITH HEAT—(5). *Syrupus*—65 p. Sugar; Dist. Water to 100 p. *Calcis*—5 p. Lime; 30 p. Sugar; Water to 100 p. *Ferri Bromidi*—10 per cent. Ferrous Bromide; 60 p. Sugar; Dist. Water to 100 p. *Ferri Iodidi*—10 per cent. Ferrous Iodide; 60 p. Sugar; Dist. Water to 100 p. *Rubi Idæi*—40 p. fermented and filtered Raspberry juice; 60 p. Sugar.

2. SIMPLE ADDITION—(9). *Syrupus Acaciæ*—25 p. Mucilage; Syrup to 100 p. *Acidi Citrici*—8 p. Cit. Acid; 4 p. Sp. Lemon; 8 p. Water; Syrup to 1000 p. *Rhei Aromaticus*—10. p. Arom. Tr. Rhei; Syrup to 100 p. *Ipecacuanhæ*—5 p. Fld. Ext. Ipecac.; 95 p. Syrup. *Krameriæ*—35 p. Fld. Ext. Kram.; 65 p. Syrup. *Lactucarii*—5 p. Fld. Ext. Lac.; 95 p. Syrup. *Rosæ*—10 p. Fld. Ext. Rose; 90 p. Syrup. *Rubi*—20 p. Fld. Ext. Rubus; 80 p. Syrup. *Senegæ*—160 p. Fld. Ext. Senega; 4 p. Aq. Ammon.; 600 p. Sugar; Water to 1000 p.

3. AGITATION WITHOUT HEAT—(18). *Syrupus Allii*—15 p. Garlic; 60 p. Sugar; 40 p. Dil. Acet. Acid. *Scillæ*—40 p. Vinegar Squill; 60 p. Sugar. *Althæa*—4 p. Alth.; 60 p. Sugar; Water to 100 p. *Pruni Virginianæ*—12 p. W. Cherry; 5 p. Glyc.; 60 p. Sugar; Water to 100 p. *Rhei*—90 p. Rhei; 6 p. K_2CO_3; 18 p. Cin.; 600 p. Sugar; Water to 1000 p. *Sennæ*—33 p. Senna; 60 p. Sugar; 4. p. Alcohol; Ol. Coriand., 1 per cent. of the amount of Alcohol; Water to 100 p. *Amygdalæ*—10 p. Sweet Almond; 3. p. Bitter Almond; 50 p. Sugar; 5 p. Orange Fl. Water; Water to 100 p. *Limonis*—40 p. Lemon Juice; 2 p. Lemon Peel; 60 p. Sugar. *Aurantii*—5 p. Sweet Or. Peel; 60 p. Sugar; Water to 100 p. *Sarsaparillæ Compositus*—150 p. Sarsaparilla; 20 p. Guaiaca Wood; 12 p. Pale Rose; 12 p. Glycyrrhiza; 12 p. Senna; 6 p. Sassafras; 6 p. Anise; 6 p. Gaultheria; 600 p. Sugar; Dil. Alch. and Water to 1000 parts. *Scillæ Compositus*—120 p. Squill; 120 p. Senega; 3 p. Tart. Emetic; 1200 p. Sugar; 9 p. Prec. Phos. Calcium; Dil. Alch. and Water to 2000 p. *Zingiberis*—2 p. Fld. Ext. Ginger; 65 p. Sugar; Water to 100 p. *Aurantii Florum*—35 p. Or. Fl. Water; 65 p. Sugar. *Ferri Quininæ et*

Strychninæ Phosphatum—133 p. Phos. Iron; 133 p. Quinine; 4 p. Strychnine; 800 p. Phosph. Acid; 6000 p. Sugar; Dist. Water to 10,000 p. *Hypophosphitum*—35 p. Ca; 12 p. Na; 12 p. K (Hypophosphite); 1 p. Citric Acid; 2 p. Spts. Lemon; 500 p. Sugar; Water to 1000 p. *Hypophosphitum cum Ferro*—1 p. Lactate of Iron; 99 p. Syrup Hypophos. *Acidi Hydriodici*—1 per cent. Absolute Hydriodic Acid; Syrup; Spt. Orange; Sugar; Dist. Water to 1000 p. *Calcii Lactophosphatis*—22 p. Precip. Phos. Ca; 33 p. Lac. Acid; 80 p. Or. Fl. Water; 600 p. Sugar; HCl; Water of Ammon.; Water to 1000 p.

4. Maceration or Digestion—(2). *Syrupus Picis Liquidæ*—6 p. Tar; 12 p. Cold Water; 50 p. Boiling Dist. Water; 60 p. Sugar. *Tolutanus*—4 p. Tolu; 65 p. Sugar; Dist. Water to 100 p.

MELLITA—HONEYS.

What are Mellita or Honeys? Thick liquid preparations closely allied to syrups, differing merely in the use of honey as a base, instead of syrup.

There are three officinal honeys:—

1. *Mel;* Commercial Honey. A saccharine secretion deposited in the honey-comb by Apis Mellifica. 2. *Mel Despumatum;* Clarified Honey. Commercial honey clarified by heating and straining. 3. *Mel Rosæ*—8 p. R. Rose (40 pulv.); 92 p. Clar. Honey; alcohol q. s.; percolate and add honey.

MUCILAGINES—MUCILAGES.

What are Mucilagines or Mucilages? Thick, viscid, adhesive liquids, produced by dissolving gum in water, or by extracting with water the mucilaginous principles from vegetable substances.

There are five officinal mucilages:—

1. Without Heat—(3). *Mucilago Acaciæ*—34 p. Acacia; Water to 100 p. *Cydonii*—2 p. Quince seed; Dist. Water to 100 p. *Sassafras Medullæ*—2 p. Sas. Pith; Water to 100 p.

2. With Heat—(2). *Mucilago Tragacanthæ*—6 p. Tragacanth; 18 p. Glycerin; Water to 100 p. *Ulmi*—6 p. Elm; Boiling Water to 100 p.

MISTURÆ—MIXTURES.

What are Misturæ or Mixtures? Aqueous liquid preparations intended for internal use, which contain suspended insoluble substances.

There are eleven officinal mixtures:—

Mistura Ammoniaci—4 p. Am.; 100 p. Water. *Asafœtida*—4 p. As.; 100 p. Water. *Amygdalæ*—6 p. Sweet Almond; 1 p. Acacia; 3 p. Sugar; 100 p. Water. *Chloroformi*—8 p. Chloroform; 2 p. Camph.; 10 p. Fresh Yolk Egg; 80 p Water. *Cretæ*—20 p. Comp. Chalk Powd.; 40 p. Cin. Water; 40 p. Water. *Ferri Composita*—6 p. Sulph. Iron; 8 p. K_2CO_3; 18 p. Myrrh; 18 p. Sugar; 50 p. Spts. Lav.; 900 p. Rose Water. *Glycyrrhizæ Composita* (Brown mixture)—3 p. Pure Ext. Glycyrr.; 3 p. Sugar; 3 p. Acacia; 12 p. Tr. Opii Cam.; 6 p. Vin. Ant.; 3 p. Spts. Æth. Nit.; 70 p. Water. *Magnesiæ et Asafœtidæ* (Dewees' carminative)—5 p. Carb. Mag.; 7 p. Tr. Asafœt.; 1 p. Tr. Opii; 10 p. Sugar; 77 p. Dist. Water. *Ferri et Ammonii Acetatis* (Basham's mixture)—2 p. Tr. Fer. Chlor.; 3 p. Dil. Acet. Acid; 20 p. Sol. Ammon. Acet.; 10 p. Elix. Orange; 15 p.

Syrup; 50 p. Water. *Rhei et Sodæ*—30 p. $NaHCO_3$; 30 p. Fl. Ext. Rhei; 30 p. Spt. Pep.; 910 p. Water. *Potassii Citratis* (neutral mixture)—Fresh Lemon Juice; Bicarb. Potas. q. s. to saturate.

GLYCERITÆ—GLYCERITES.

What are Glyceritæ, or Glycerites? Mixtures of medicinal substances with glycerin.

There are two officinal glycerites:—

Glyceritum Amyli—10 p. Starch; 90 p. Glycerin (translucent jelly). *Vitelli*—45 p. Fresh Yolk Egg; 55 p. Glycerin.

ALCOHOLIC SOLUTIONS.

SPIRITUS—SPIRITS.

What are Spiritus, or Spirits? Alcoholic solutions of volatile substances.

There are twenty-two officinal spirits (five classes):—

1. Simple Solutions—(15). *Spiritus Ætheris*—30 p. Stronger Ether; 70 p. Alcohol. *Ætheris Compositus*—30 p. Str. Eth.; 3 p. Eth. Oil; 67 p. Alcohol. *Ammoniæ Aromaticus*—4. p. Ammon. Carb.; 10 p. Ammon. Water; 1.2 p. Ol. Lemon; 0.1 Ol. Lav. Flor.; 0.1 Ol. Pimenta; 70 p. Alcohol; 15 p. Water. *Anisi*—10 p. Ol. Anise; 90 p. Alcohol. *Aurantii*—6. p. Ol. Orange Peel; 94 p. Alcohol. *Camphoræ*—10 p. Cam.; 70 p. Alcohol; 20 p. Water. *Chloroformi*—10 p. Purif. Chlor.; 90 p. Alcohol. *Cinnamomi*—10 p. Ol. Cin.; 90 p. Alcohol. *Gaultheriæ*—3 p. Ol. Gaul.; 97 p. Alcohol. *Juniperi*—3 p. Ol. Jun.; 97 p. Alcohol. *Juniperi Compositus*—.2 p. Ol. Jun.; 0.02 Ol. Caraway; 0.02 Ol. Fennel; 60 p. Alcohol; 40 p. Water. *Lavendulæ*—3 p. Ol. Lav. Fl.; 97 p. Alcohol. *Myrciæ*—.88 p. Ol. Myrcia; 0.05 Ol. Orange Peel; 0.05 p. Ol. Pimenta; 56 p. Alcohol; 44 p. Water. *Myristicæ*—3 p. Ol. Nutmeg; 97 p. Alcohol. *Odoratus*—1.6 Ol. Berg.; 0.8 Ol. Lem.; 0.8 Ol. Rosemary; 0.4 Ol. Lav.; 0.4 Ol. Orange Fl.; 0.2 p. Acetic Ether; 15.8 p. Water; 80 p. Alcohol.

2. With Maceration—(3). *Spiritus Limonis*—6 p. Ol. Lem.; 4 p. Lem. Peel (fresh); Alcohol to 100 p. *Menthæ Piperitæ*—10 p. Ol. Pep.; 1 p. Pip. Herb.; Alcohol to 100 p. *Menthæ Viridis*—10 p. Spearmint; 1 p. Spearmint Herb; Alcohol to 100 p.

3. By Gaseous Solution.—*Spiritus Ammoniæ*—Stronger Am. Water; Heat; Alcohol; 10 per cent. gas; assay.

4. By Chemical Reaction.—*Spiritus Ætheris Nitrosi*—5 per cent. Ethyl Nitrite.

5. By Distillation.—*Spiritus Frumenti*—From fermented grain; must be two years old. *Vini Gallici*—From fermented grapes; must be at least four years old.

ELIXIRIA—ELIXIRS.

What are Elixiria, or Elixirs? Elixirs are aromatic, sweetened, spirituous preparations, containing small quantities of active medicinal substances.

Name the only officinal elixir. *Elixir Aurantii* [simple elixir]—1. p. Ol. Orange; Cotton, 2 p.; Sugar, 100 p.; Dilute Alcohol and Water to 300 p.

ETHEREAL SOLUTIONS.

COLLODIA—COLLODIONS.

What are Collodia, or Collodions? Collodions are liquid preparations intended for external use, having for the base a solution of Pyroxylin, or gun-cotton, in a mixture of ether and alcohol. They leave a film on evaporation, which serves as a protection or an application of a medicinal ingredient to the skin. In the following description: P. = Pyroxylin; S. E. = Stronger Ether; A. = Alcohol.

There are four officinal collodions:—*Collodium*—4 p. P.; 70 p. S. E.; 26 p. A.; decant the clear collodion from the sediment. *Collodium cum Cantharidi*—60 p. Canthar.; 85 p. Flex. C.; Commercial Chlor. q. s. to exhaust Canth.; after dist. should weigh 15 p.; decant the clear Canthar. Collod. from the sediment. *Flexile*—92 p. Col.; 5 p. Canada Turpentine; 3. p. Castor Oil. *Stypticum*—20 p. Tannic Acid; 5 p. A.; 20 p. S. E.; 55 p. Col.

OLEAGINOUS SOLUTIONS, OR EXTERNAL APPLICATIONS.

LINIMENTA—LINIMENTS.

There are ten officinal liniments (three classes):—

1. Base, Cotton Seed Oil.—*Linimentum Ammoniæ*—30 p. Ammon. W.; 70 p. Oil. *Calcis*—50 p. Lime W.; 50 p. Oil. *Camphoræ*—20 p. Cam.; 80 p. Oil. *Plumbi Subacetatis*—40 p. Liq. P. Subacet.; 60 p. Oil.

2. Base, Alcohol.—*Linimentum Belladonnæ*—5 p. Cam.; 95 p. Ext. Bel. fl. *Chloroformi*—40 p. Com. Chlorof.; 60 p. Soap Lin. *Saponis*—10 p. Soap; 5 p. Cam.; 1 p. Ol. Rosemary; 70 p. A.; 14 p. W. *Sinapis Compositum*—3 p. Vol. Ol. Mustard; 2 p. Ext. Mezereum; 6 p. Cam.; 15 p. Cas. Ol.; 74 p. Alcohol.

3. Base, Oil of Turpentine.—*Linimentum Cantharidis*—15 p. Canth.; 85 p. Ol. Turp. *Terebinthinæ*—65 Res. Cerate.; 35 p. Ol. Turp.

OLEATA—OLEATES.

What are Oleata, or Oleates? The officinal oleates are liquid preparations, made by dissolving metallic salts, or alkaloids, in oleic acid. They are not assumed to be definite chemical compounds.

There are two officinal oleates:—*Oleatum Hydrargyri*—10 p. Yel. Ox. Hg; 99 p. Ol. Acid. *Veratrinæ*—2 p. Veratrine; 98 p. Ol. Acid.

AQUEOUS LIQUIDS MADE BY PERCOLATION OR MACERATION.

INFUSA—INFUSIONS.

What are Infusa, or Infusions? Infusions are liquid preparations, made by treating vegetable substances with either hot or cold water. They are not boiled, though boiling water is often employed.

INFUSIONS—FOUR METHODS.

1. Prepared by Maceration.—General Formula, U. S. P. "An ordinary infusion, the strength of which is not directed by the physician,

nor specified by the Pharmacopœia, shall be prepared by the following formula:—

"Take of— By Measure.

THE SUBSTANCE, coarsely comminuted,
10 parts, or . . . . . 1 ounce Av.
BOILING WATER, 100 parts, or . . . 10 fluid ounces.
WATER, a sufficient quantity

To make 100 parts, or . . . . . 10 fluid ounces.

"Put the substance into a suitable vessel provided with a cover, pour upon it the Boiling Water, cover the vessel tightly, and let it stand for two hours. Then strain, and pass enough water through the strainer to make the infusion weigh *one hundred parts*, or measure 10 fluid ounces.

"*Caution.*—The strength of infusions of energetic or powerful substances should be specially prescribed by the physician."

Various styles of infusion jars, pitchers and mugs, are described in Remington's "Practice of Pharmacy."

Infusum Brayera—6 per cent. Koosso; Boiling W.; don't strain. *Digitalis*—1½ per cent. Dig.; 1½ per cent. Cin.; 7½ per cent. Alcohol; Boiling W. *Sennæ Compositum*—6 per cent. Senna; 12 per cent. Manna; 12 per cent. Mag. Sulph.; 2 per cent. Fennel; Boiling W.

2. BY DIGESTION.—Let stand at moderate heat below boiling. Very useful method, though it may not be directed in formula.

3. BY PERCOLATION.—Should be used whenever practicable. *Infusum Cinchonæ*—6 per cent. Cinch.; 1 per cent. Arom. Sulph. Acid and Water. *Pruni Virginianæ*—4 per cent. Wild-Cherry Bark; Water.

4. BY DILUTING FLUID EXTRACTS.—"Improper and unjustifiable, except in those few cases in which the active and desirable principles of the drug are equally soluble in alcohol and in water, or in the menstruum used for both fluid extract and infusion."

DECOCTA—DECOCTIONS.

What are Decocta, or Decoctions? Decoctions are liquid preparations, made by *boiling* vegetable substances with water.

For description of various decoction vessels, see Remington's "Practice of Pharmacy."

General Officinal Formula.—"An ordinary decoction, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula:—

"Take of— By Measure.

THE SUBSTANCE, coarsely comminuted.
10 parts, or . . . . . 1 ounce Av.
WATER, sufficient quantity

To make 100 parts, or . . . . . 10 fluid ounces.

"Put the substance in a suitable vessel provided with a cover, pour upon it *100 parts* [or 10 fluid ounces] of cold water, cover it well, and boil for fifteen minutes; then let it cool to about 45° C. (113 F.), strain the liquid,

and pass through the strainer enough cold water to make the product weigh *100 parts* [or measure 10 fluid ounces].

"*Caution.*—The strength of decoctions of energetic or powerful substances should be specially prescribed by the physician."

Decoctum Cetrariæ—5 p. Cetraria; W. to 100 p. *Sarsaparillæ Compositum*—Sar. 10 p.; Sas. 2 p.; Guaiac Wood 2 p.; Glycyr. 2 p.; Mezereum 1 p.; W. to make 100 p.

ALCOHOLIC LIQUIDS MADE BY PERCOLATION OR MACERATION.

TINCTURÆ—TINCTURES.

What is a Tincture? A tincture is an alcoholic solution of a medicinal substance.

How does a Tincture differ from a Spirit? The latter, with one exception, are solutions of *volatile* substances in alcohol, while the former are of non-volatile substances.

By what processes may Tinctures be prepared? By *percolation*, *maceration*, *solution*, or *dilution*.

What menstrua are used in preparing them? Alcohol, diluted alcohol of various strengths, aromatic spirits of ammonia, or mixtures of alcohol, water and glycerine.

How many officinal Tinctures are there? Seventy three.

Give an example of a Tincture made by solution or dilution. Tr. Iodine is an example. It is made by dissolving Iodine in alcohol.

Into what two general classes may Tinctures be divided? Into simple and compound Tinctures.

Why is Glycerin used in Tinctures? To prevent precipitation on standing.

COMPOUND TINCTURES.

There are fifteen compound Tinctures :—

Tinctura Opii Camphorata—.4 p. Opium; .4 p. Benz. Acid; .4 p. Oil Anisi; .4 p. Camphor; .4 p. Glycerin; Menstruum dilute Alcohol. *Lavandulæ Composita*—.8 p. Oil Lav.; .2 p. Oil Rosemary; 1.8 p. Cinnamon; .4 p. Cloves; 1 p. Nutmeg; .8 p. Red Saunders; Menstruum (68 p. A.; 27 p. W.). *Cardamômi Composita*—2 p. Card.; 2 p. Cinnamon; 1 p. Caraway; .5 p. Cochineal; Mens. Dil. A.; 6 per cent. Glycer. *Gentianæ Composita*—8 p. Gent.; 4 p. Bit. Orange Peel; 2 p. Cardamon; Mens. Dil. A. *Rhei*—12 p. Rhub.; 2 p. Card.; Mens. Dil. A.; *Conii*—15 p. Conium; .4 per cent. Dil. HCl; Mens. Dil. A. *Rhei Dulcis*—8 p. Rhub.; 4 p. Glycyrrhiz.; 4 p. Anise; 1 p. Card.; Mens. Dil. A. *Aloes et Myrrhæ*—10 p. Aloes; 10 p. Myrrha.; Mens. A. *Aloes*—10 p. Aloes; 10 p. Glycyrrhiz.; Mens. Dil. A. *Catechu Composita*—12 p. Catechu; 8 p. Cinnamon; Mens. Dil. A. *Ipecacuanhæ et Opii*—10 p. Fld. Ext. Ipecac.; Decod. Tr. Opii to 100 p.; Mens. Dil A. *Cinchonæ Compositæ*—10 p. R. Cinch.; 8 p. B. Orange Peel; 2 p. Serp.; Mens. A. 80, W. 10, Glycer. 10. *Benzoini Composita*—12 p. Benz.; 2 p. Aloes; 8 p. Storax; 4 p. Bals. Tolu; Mens. A. *Rhei Aromatica*—20 p. Rhub.; 4 p. Cinnam.; 4 p. Cloves; 2 p. Nutmeg; Mens. Dil. A. *Aconiti*—40 p. Ac. root; 4 p. Tart. Acid; Mens. A. *Ferri Acetatis*—50 p. Sol. Ac. Iron; 20 p. Acetic Ether; Mens A. *Saponis Viridis*—65 p. Green Soap; 2 p. Ol. Lav.; Mens. A.

SIMPLE TINCTURES.

There are 58 simple tinctures. They may be arranged according to strength of drug, as follows: 2, 5 per cent. Tinctures—*Tinctura Capsici; Cantharidis.* 1, 8 per cent. tincture—*Iodi.* 20 10 per cent. tinctures—*Opii; Sumbul; Serpentariæ; Stramonii; Matico; Moschi; Ignatiæ; Chiratæ; Physostigmatis; Bryoniæ; Arnicæ Radicis; Croci; Kino; Tolutana; Cubebæ; Opii Deodorata; Calumbæ; Cinnamomi; Vanillæ; Quassiæ.* 8, 15 per cent. tinctures—*Gelsemii; Belladonnæ; Cardamomi; Hyoscyami; Scillæ; Sanguinariæ; Colchici; Digitalis.* 22, 20 per cent. tinctures—*Cannabis Indicæ; Cimicifugæ; Asafœtidæ; Benzoini; Guaiaci; Pyrethri; Aurantii Dulcis; Zingiberis; Guaiaci Ammoniata; Valerianæ Ammoniata; Humuli; Gallæ; Cinchonæ; Krameriæ; Myrrhæ; Arnicæ Florum; Lobeliæ; Hydrastis; Valerianæ; Nucis Vomicæ; Aurantii Amari; Calendulæ.* 1, 35 per cent. tincture—*Ferri Chloridi,* 1, 50 per cent. tincture—*Veratri Viridis.*

TINCTURES OF RECENT PLANTS.

How would you prepare the U. S. P. Tincturæ Herbarum Recentium? "These Tinctures, when not otherwise directed, are to be prepared by the following formula:—

Take of	By Measure.
The Fresh Herb, bruised or crushed, 50 parts, or	16 oz.
Alcohol, 100 parts, or	2½ pints.

"Macerate the Herb with the alcohol for fourteen days, then express the liquid and filter (50 per cent. fresh herb)."

VINA MEDICATA—MEDICATED WINES.

What are Vina Medicata or Medicated Wines? Medicated Wines are liquid preparations containing the soluble principles of medicinal substances dissolved in Wine.

There are fourteen officinal wines. Four classes:—

1. NOT MEDICATED.—*Vinum Album*—"A pale, amber-colored or straw-colored, alcoholic liquid, made by fermenting the unmodified juice of the grape, freed from seeds, stems and skins." *Album Fortius*—7 p. White Wine; 1 p. Alcohol. *Rubrum*—"A deep red, alcoholic liquid, made by fermenting the juice of colored grapes in presence of their skins."

BY SOLUTION.—*Vinum Antimonii*—4 p. Tart Emet.; 60 p. Boiling Dist. W.; Str. Wht. Wine to 1000 p. *Ferri Amarum*—8 p. Sol. Cit. Iron and Quinine; 12 p. Tr. Aurant. Dulc.; 36 p. Syr.; 44 p. Str. Whit. Wine. *Ferri Citratis*—4 p. Cit. Iron and Ammon.; 12 p. Tr. Aurant. Dulc.; 12 p. Syr.; ½ p. Str. W. Wine. *Ipecacuanhæ*—7 p. Ext. Ipecac. Fld.; 93 p. Str. W. Wine.

3. BY MACERATION.—*Vinum Aloes*—6 p. Pur. Aloes; 1 p. Card.; 1 p. Ginger (all in 40 Powd.); Mac. with 90 p. Str. W. W. for 7 ds., filter; add Str. W. W. to 100 p. *Colchici Seminis*—15 p. Colch. S. (20 Pow.); Str. W. W. to 100 p. *Opii.*—10 p. Opium; 1 p. P. Cin.; 1 p. P. Cloves; 90 p. Str. W. W.; Macerate 7 ds.; filter, add Str. W. W. to 100.

4. BY PERCOLATION.—*Vinum Aromaticum.*—1 p. each, Lav., Origan., Pep., Rosemary, Sage and Wormwood; Percolate with Str. W. W. to 100

p. *Colchici Radicis*—40 p. Colch. R. (30 P.); Perc. with Str. W. W. to 100 p. *Ergotæ*—15 p. Erg. (30 Powd.); Perc. with Str. W. W. to 100 p. *Rhei*—10 p. Rheum (30 P.); 1 p. Calamus (30 P.); Per. Str. W. W. to 100 p.

EXTRACTA FLUIDA.—FLUID EXTRACTS.

What is a Fluid Extract? Fluid extracts are liquid alcoholic preparations of uniform and definite strength, made by precolating drugs with menstrua, and concentrating a portion of the percolate, so that in each case a cubic centimetre represents the medicinal virtue of one gramme of the drug; they are mostly concentrated tinctures.

What is the characteristic peculiarity of Fluid Extracts? One *minim* of fluid extract always represents one *grain* of the drug from which it is prepared.

What great advantages do they possess over tinctures? They are uniform, definite and concentrated.

What advantages do tinctures possess over Fluid Extracts? 1st. In some cases the alcohol menstruum of the tincture is to be desired. 2d. Tinctures may be added in small proportions to aqueous preparations, without serious precipitation.

Give the five principal methods of preparing Fluid Extracts now in use. 1. Percolation with partial evaporation (officinal). 2. Percolation with incomplete exhaustion. 3. Repercolation (Squibb). 4. Maceration with hydraulic pressure (Parke, Davis & Co.). 5. Vacuum maceration with percolation (Duffield).*

Give a Typical Formula for an officinal Fluid Extract. "100 grammes of the powdered drug is moistened with a certain quantity of menstruum, packed in a suitable percolator, and enough menstruum added to saturate the powder and leave a stratum above it; the lower orifice of the percolator is closed when the liquid begins to drop, and the percolator is closely covered to prevent evaporation and permit maceration for a specified time; additional menstruum is poured on, and percolation continued until the drug is exhausted. Usually from seven to nine-tenths of the first portion of the percolate is reserved, and the remainder evaporated at a temperature not exceeding 50° C. (122° F.) to a soft extract; this is to be dissolved in the reserved portion, and enough menstruum added to make the fluid extract measure 100 c. c." (Remington.)

Why is the latter portion of the percolate reserved and evaporated to a soft extract? The evaporation of the latter portion of the percolate permits concentration of the preparation without exposing the stronger portion to heat.

What is meant by Percolation with Incomplete Exhaustion? This modification of the officinal process is based on the principle that the first seventy-five per cent. of the percolate contains seventy-five per cent. of drug. Acting under this assumption, the process is stopped here, and the fluid extract declared finished, and of full strength.

What is claimed in favor of this method? Saving of alcohol, and

* For a full description of the processes of Squibb, Parke, Davis & Co., and S. P. Duffield, illustrated with cuts of the apparatus employed, see Remington's "Practice of Pharmacy."

the use of heat. It is claimed that the wastage of alcohol comes from trying to recover the remaining 25 per cent. of the activity of the drug; and the use of heat is entirely obviated.

What is urged against the method? If percolation is properly conducted, the first 75 per cent. of the percolate probably does contain 75 per cent., or more, of the desired portions of the drug. But the officinal process, by carrying the percolation to complete exhaustion, insures against want of care and skill in conducting the operation, as the remaining activities are secured by the continuance of the percolation and final concentration.

There are seventy-nine officinal extracts, eleven classes:—

1. Menstruum Alcohol—(21): *Extractum Aconiti Fluidum; Aromaticum; Belladonnæ; Brayera; Calami; Cannabis Indicæ; Capsici; Cimicifugæ; Cubebæ; Cypripedii; Sabinæ; Sanguinariæ; Xanthoxyli; Ipecacuanhæ; Veratri Viridis; Lupulini; Eucalypti; Gelsemii; Scillæ; Mezerei; Zingiberis.*

2. Menstruum Alcohol, 8; Water, 1—(1): *Nucis Vomicæ.*

3. Menstruum Alcohol, 3; Water, 1—(10): *Hydrastis; Hyoscyami; Grindeliæ; Guaranæ; Serpentariæ; Stramonii; Digitalis; Rhei; Iridis; Podophylli.*

4. Menstruum Alcohol, 2; Water, 1—(7): *Aurantii Amari; Buchu; Colchici Radicis; Colchici Seminis; Senegæ; Valerianæ; Viburni.*

5. Menstruum Dil. Alcohol—(14): *Arnicæ Radicis; Calumbæ; Gentianæ; Conii; Dulcamaræ; Rumicis; Glycyrrhizæ; Spigeliæ; Stillingiæ; Pilocarpi; Erythroxyli; Lobeliæ; Eupatorii; Quassiæ.*

6. Menstruum Containing Glycerine—(17): *Chimaphilæ; Leptandræ; Rosæ; Rubi; Matico; Gossypii; Cornus; Geranii; Uvæ Ursi; Chiratæ; Sarsaparillæ; Pruni Virginianæ; Sarsaparillæ Compositus; Rhois Glabræ; Pareiræ; Cinchonæ: Krameriæ,*

7. Menstruum Alcohol, 3; Water, 4—(2): *Sennæ; Ergotæ.*

8. Menstruum Alcohol, 2; Water, 3—(1): *Taraxaci.*

9. Menstruum Alcohol, 1; Water, 2—(3): *Frangulæ; Hamamelidis; Scutellariæ.*

10. Menstruum (Ether), Alcohol, Water—(1): *Lactucarii.*

11. Menstruum Boiling Water—(2): *Tritici; Castaneæ.*

ETHEREAL LIQUIDS MADE BY PERCOLATION.

OLEORESINÆ—OLEORESINS.

What are Oleoresinæ, or Oleoresins? The oleoresins are officinal liquid preparations, consisting principally of natural oils and resins extracted from vegetable substances by percolation with stronger ether. They are the strongest liquid preparations of drugs produced.

Give a general formula for their preparation. Percolate the powdered drug, in a cylindrical percolator provided with a cover and receptacle suitable for volatile liquids, with stronger ether, until exhausted, recovering the greater part of the ether by distillation, and exposing the residue, in a capsule, to spontaneous evaporation until the remaining ether has evaporated.

There are six officinal resins:—

Oleoresina Aspidii—yield 10 to 15 per cent.; *Capsici*—yield 5 per cent.; *Cubebæ*—yield 18 to 25 per cent.; *Lupulini*—yield 50 per cent.; *Piperis*—yield 5 per cent.; *Zingiberis*—yield 6 to 8 per cent.

ACETOUS LIQUIDS MADE BY PERCOLATION.

ACETA—VINEGARS.

What are Aceta, or Vinegars? Medicated vinegars are solutions of the active principles of drugs in diluted acetic acid, the latter being chosen as a menstruum because acetic acid is not only a good solvent, but also possesses antiseptic properties. Their use dates from the time of Hippocrates.

What menstruum is used for their preparation? Acetic Acid, 1 p.; Water, 7 p. Acetic acid is of value as a menstruum, as it produces soluble salts with the alkaloidal principles existing in plants.

There are four officinal vinegars:—

Acetum Lobeliæ—10 p. Lob. (30 powd.); percolate with Dil. Acetic Acid to 100 p. *Opii*—10 p. Powd. Opium; 3 p. Powd. Nutmeg; 20 p. Sugar; percolate with Dil. Acetic Acid to 100 p. *Sanguinariæ*—10 p. Sang. (30 powd.); percolate with Dil. Acetic Acid to 100 p. *Scillæ*—10 p. Squill. (30 powd.); percolate with Dil. Acetic Acid to 100 p.

SOLIDS.

SOLID PREPARATIONS MADE BY PERCOLATION OR MACERATION.

EXTRACTA—EXTRACTS.

What are Extracta, or Extracts? "Extracts are solid or semi-solid preparations, produced by evaporating solutions of vegetable substances." (Remington.)

There are thirty-two officinal extracts:

1. With Alcoholic Menstrua (19).

General Formula.—"Percolate the powdered drug with the menstruum directed, until it is exhausted; reserve the first third of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), until it weighs 10 per cent. of the weight of the drug. Mix this with the reserved portion, and evaporate both, at the above temperature, to a pilular consistence. Or, instead of reserving part of the percolate, the whole quantity is distilled until the alcohol is recovered, and the residue is evaporated to a pilular consistence. In the case of these extracts, which are apt to become hard, five per cent. of glycerin is added, to enable them to retain their consistence."

Directions for making Extract of Aconite, as directed by the U. S. Pharmacopœia, illustrating the method for manufacturing this class of extracts:

Extractum Aconiti—Extract of Aconite.

Aconite, in No. 60 powder, one hundred parts . . . . . 16 ounces Av.
Tartaric Acid, one part . . . . . 70 grains.
Glycerin,
Alcohol, each *sufficient quantity*.

Moisten the powder with *forty* (40) parts (or 7½ fluid ounces) of alcohol in which the tartaric acid has previously been dissolved, and pack it firmly in a cylindrical glass percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding alcohol until three hundred parts (or 3½ pints) of tincture are obtained, or the aconite is exhausted. Reserve the first *ninety* parts (or 15½ fluid ounces) of the percolate, evaporate the remainder in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to *ten* parts (or 1½ fluid ounces), add the reserved portion, and evaporate at or below the above-mentioned temperature, until an extract of pilular consistency remains. Lastly, weigh the extract and thoroughly incorporate with it, while still warm, *five per cent.* of glycerin.

Sub-class 1.—Menstruum, alcohol—(5) *Extractum Aconiti* (root, with 1 per cent. Tart. Acid): *Mezerei; Physostigmatis; Cannabis Indicæ; Juglandis.*

Sub-class 2.—Menstruum, alcohol 8, water 1—(1) *Extractum Nucis Vomicæ.*

Sub-class 3.—Menstruum, alcohol 3, water 1—(4) *Extractum Cinchonæ; Iridis; Podophylli; Rhei.*

Sub-class 4.—Menstruum, alcohol 2, water 1—(4) *Extractum Belladonnæ Alcoholicum* (leaves); *Hyoscyami Alcoholicum; Digitalis; Leptandrinæ.*

Sub-class 5.—Menstruum, diluted alcohol—(5) *Extractum Arnicæ Radicis; Conii Alcoholicum* (fruit); *Euonymi; Stramonii* (seed); *Colocynthidis* (fruit from seeds.)

Sub-class 6.—Menstruum, alcohol 3, water 4—(1) *Extractum Ergotæ.*

2. Made with Aqueous Menstrua (11): *Extractum Aloes Aquosum; Hæmatoxyli; Opii; Malti; Taraxaci; Gentianæ; Glycyrrhizæ Purum* (water containing 5 per cent. Water of Ammonia to dissolve Glycyrrhizin); *Krameriæ; Quassiæ; Colchici Radicis* (water containing 23.3 per cent. of officinal Acetic Acid); *Glycyrrhizæ.*

3. Compound Extract.—*Extractum Colocynthidis Compositum*—Ext. Col., 16 per cent.; Aloes, 50 per cent.; Card., 6 per cent.; Scam., 14 per cent.; Soap, 14 per cent.; Alcohol, 10 per cent. of the combined weight of the other ingredients.

ABSTRACTA—ABSTRACTS.

What are Abstracta, or Abstracts? "Abstracts are solid powdered preparations, containing the soluble constituents of the drugs from which they are made, and bearing a definite and uniform relation to the drug." (Remington.)

How are they prepared? "They are prepared by evaporating an alcoholic tincture of a drug spontaneously, and at a low temperature, mixing it with a sufficient quantity of dried sugar of milk to make the final product, when dry, weigh one-half the weight of the drug, and then powdering it."

Give a general formula for the preparation, as directed by the U. S. P. "Drugs in No. 60 powder, *two hundred parts* [or four ounces Av.]; Sugar of Milk, recently dried, and in fine powder; Alcohol, each, *a sufficient quantity*, to make *one hundred parts* [or two ounces Av.].

Moisten the drug with *eighty parts* [or 1¾ fluid ounces] of alcohol, and pack firmly in a cylindrical glass percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding alcohol until the drug is exhausted. Reserve the first *one hundred and seventy parts* [or 3½ fluid ounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluid ounce] at a temperature not exceeding 50° C. (122° F.), and mix with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty* parts [or one ounce Av.] of sugar of milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough of sugar of milk to make the mixture weigh *one hundred parts* [or two ounces Av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle.

Name the advantages possessed by this class of preparations.

1. "Each abstract represents twice the strength of the drug or fluid extract from which it is prepared."

2. "They are dry powders, if properly made, and thus are permanent and portable; not subject to precipitation, as fluid extracts are; not liable to become hard, brittle, and variable in strength, as is the case with extracts."

3. "Injurious exposure to heat is entirely avoided, and the officinal process requires no apparatus but such as either is at hand in the pharmacy or can be easily obtained by a pharmacist operating upon a small scale."

4. "The final thorough trituration of the dry powder reduces the soluble and active constituents of the drug to a pulverulent condition, the diluent is soluble, and the fine state of division of abstracts is the most favorable condition that a powder can possess to secure efficient medication.

There are eleven abstracts. Two classes:—

1 (9).—Menstruum, alcohol—*Abstractum Aconiti* (2 per cent. Tart. Acid added to menstruum to exhaust root); *Belladonnæ* (root); *Conii* (6 per cent. HCl added to menstruum to exhaust fruit); *Digitalis; Hyoscyami; Jalapæ; Podophylli; Senegæ; Valerianæ.*

2 (2).—Menstruum, alcohol 8, water 1—*Ignatiæ, Nucis Vomicæ.*

RESINÆ—RESINS.

What are Resinæ, or Resins? The officinal resins are solid preparations, consisting principally of the resinous principles from vegetable bodies, prepared by precipitating them from their alcoholic solution with water.

There are four officinal resins:—

Resina Copaibæ (left after distilling off volatile oil); *Jalapæ* (pouring a tincture into water); *Podophylli* (pouring a tincture into water acidulated with HCl); *Scammonii* (pouring a tincture, made by digesting Scammony in boiling alcohol, into water).

SOLID PREPARATIONS MADE WITHOUT PERCOLATION OR MACERATION.

PULVERES—POWDERS.

There are nine officinal powders:—

Pulvis Antimonialis—Antimonial Powder [James' Powder]—Ox. Ant. 33 p.; Precip. Phos. Calc. 67 p. = 100 p. *Aromaticus*—Cin. 35 p.; Ginger 35 p.; Card. 15 p.; Nutmeg, 15 p. = 100 p. *Cretæ Compositus*—Prep. Chalk 30 p.; Acacia 20 p.; Sugar 50 p. = 100 p. *Effervescens Compositus* [Seidlitz Powder]—Sod. Bicarb. 480 gr.; Roch. Salt. 1440 gr.; Tart Acid 420 grs.; mix Sod. Bicarb. and Roch. Salts; divide in 12 equal parts—blue papers; divide acid in 12 equal parts—white papers. *Glycyrrhizæ Compositus*—Senna 18 p.; Glycyrr. 16 p.; Fennel 8 p.; W. Sulphur 8 p.; Sugar 50 p. = 100 p. *Ipecacuanhæ et Opii* [Dover's Powder]—Ipecac, Opium, each 10 p.; Sacch. Lac. 80 p. = 100 p. *Jalapæ Compositus*—Jalap 35 p.; Cream Tart. 65 p. = 100 p. *Morphinæ Compositus* [Tully's Powder]—Sulphate of Morphia 1 p.; Camph. 20 p.; Glycyrr. 20 p.; Calc. Carb. Precip. 20 p.; Alcohol q. s. to powder the camphor. *Rhei Compositus*—Rhub. 25 p.; Magnesia 65 p.; Ginger 10 p. = 100 p.

TRITURATIONES—TRITURATIONS.

What are Triturationes, or Triturations? A new class of powders introduced into the U. S. P. of 1880, for the purpose of fixing a definite relation between the active ingredient and the diluent.

Give a general formula for their preparation, as directed by the U. S. P.

Take of

	Definite Formula.
The Substance, 10 p. or	6 grains.
Sugar of Milk, in moderately fine powder, 90 parts, or	54 grains.
To make 100 parts, or	60 grains.

Weigh the Substance and Sugar of Milk separately; then place the Substance, previously reduced, if necessary, to a moderately fine powder, in a mortar; add an equal bulk of Sugar of Milk, mix well by means of a spatula, and triturate them thoroughly together. Add fresh portions of the Sugar of Milk, from time to time, until the whole is added, and continue the trituration until the Substance is intimately mixed with the Sugar of Milk, and finely comminuted.

There is one officinal trituration:—

Trituratio Elaterina—Elaterin 10 p.; Sug. Milk 90 p. = 100 p.

MASSÆ—MASSES.

What are Massæ, or Masses? Pill masses are officinal under this name. They are kept in bulk by pharmacists.

There are three officinal masses.

Massa Copaibæ—94 p. Cop.; 6 p. Mag. (recently prepared); mix intimately and set aside until it concretes. *Ferri Carbonatis*—100 p. Sulph. Iron; 110 p. Carb. Sod.; 38 p. Clarif. Honey; 25 p. Sugar; syrup and distilled water, each q. s. Dissolve Sulph. Iron and Carb. Sod., separately, in boil-

ing distilled water; add 25 p. Syrup to former; mix solutions. When cold, pour off supernatant liquid, and wash precipitate with 1 p. syrup and 16 p. water. Drain, and mix with honey and sugar, and evaporate to 100 p. *Hydrargyri*—33 p. Hg; 3 p. Glyc.; Honey of Rose 34 p.; triturate till Hg is extinguished. Add, gradually, Glycyrrhizæ 5 p.; Althæa 25 p.; continue trituration till globules of Hg cease to be visible.

CONFECTIONES—CONFECTIONS.

What are Confectiones, or Confections? Confections are saccharine, soft solids, in which one or more medicinal substances are incorporated, with the object of affording an agreeable form for their administration and a convenient method for their preservation. Old names, *conserves* and *electuaries*, under which they have been in use for centuries.

There are two officinal confections:—

Confectio Rosæ—R. Rose 8 p.; P. Sugar 64 p.; Clar. Honey 12 p.; Rose W. 16 p. *Sennæ*—Sen. 10 p.; Coriander 6 p.; Cas. Fist. 16 p.; Tamarind 10 p.; Prune 7 p.; Fig 12 p.; P. Sugar. 50 p.; Water 60 p.

PILULÆ—PILLS.

What are Pilulæ, or Pills? "Pills are small, solid bodies, of a globular, ovoid, or lenticular shape, which are intended to be swallowed, and thereby produce medical action." (Remington.)

Of what is a pill mass composed, and what is required of it? It is composed of ingredients and excipients. It is required that the mass be 1, *adhesive;* 2, *firm;* 3, *plastic.*

How are excipients divided? and give a list of the principal excipients and directions when they should be used. Excipients are liquid or solid.

LIQUID EXCIPIENTS.

1. Water: use only when ingredients possess inherent adhesiveness that water will develop.
2. Syrup: adhesive.
3. Syrup Acacia: more adhesive.
4. Mucilage Acacia: most adhesive. Pills are liable to become hard and insoluble if acacia in any form is used as excipient.
5. Glycerin: somewhat adhesive. It is hygroscopic and keeps pills soft.
6. Glucose: very adhesive. Colorless, and non-volatile at ordinary temperatures. Very valuable.
7. Honey: Good substitute for glucose, but colors white pills.
8. Extract of Malt: advantages of glucose, but disadvantage (color) of honey.
9. Glycerite of Starch: Glycerin—adhesiveness of starch and jelly. Thickness sometimes an objectionable feature.
10. Glycerite of Tragacanth: Similar to above.
11. Remington's general excipient: Glucose 4 oz. av.; Glycerin 1 oz. av.; Acacia (pulv.) 90 grains; Benzoic Acid 1 grain. Dissolve benzoic acid in the glycerine, stir in acacia, then the glucose, and let stand till dissolved. *Moderate* heat may be used.

SOLID EXCIPIENTS.

1. Confection of Rose: Useful when it is desired to dilute active ingredients and increase bulk.

2. Bread Crumb: Used in making pills to contain croton oil, volatile oils, etc.

3. Powdered Althæa: too bulky for ordinary use.

4. Soap: valuable for resinous substances. Not only makes excellent mass, but increases the solubility of resins.

5. Resin Cerate: for oxidizable substances, resins, etc.

6. Cacao Butter: for pills of permanganate of potassium, etc.

7. Petrolatum: for oxidizable substances as above.

How would you divide the mass? On a graduated pill tile, or a pill machine. The former are made of porcelain, but preferably of plate glass. In either case the pill mass is rolled into a cylinder. In the former the mass is divided into the required number of portions with a spatula. In the latter it is divided by laying it upon the grooves of the lower board in the pill machine; the upper board is applied so that the cutting surfaces correspond with those on the lower board, and "by a slight backward and forward motion, with downward pressure, the mass is divided."

How would you finish pills and keep them from adhering together? Finish them either by rolling between the thumb and finger, or rotate them under an adjustable pill finisher. To prevent them from adhering together, dust with rice flour, powdered magnesium carbonate, lycopodium, powdered althæa, or powdered licorice root.

How may pills be coated? Pills may be coated with various substances. With *gold* or *silver*, by "first placing a drop of syrup of acacia in a mortar, and after carefully spreading it over the surface with the end of the finger, dropping in the pills, rotating them so that they shall be uniformly coated with a very thin layer of mucilage, and then dropping them into the gold or silver leaf contained in the coater"—"a smooth, globular box, opening in the middle." An ordinary pill box will answer the purpose. With *gelatin*, by a simply constructed machine, in which the pills, arranged automatically in rows, are impaled on a system of pins, afterward dipped in a hot solution of gelatin, twirled gently until the coating is set, and rapidly dried by rotating on a wheel, after which they are removed from the pins. This can be accomplished in fifteen minutes. With *sugar*, by rotating them with a mixture of sugar and starch in a pill coater, which consists of a caldron-shaped copper vessel, revolving at an incline, and heated by steam. The process can only be accomplished economically on the large scale.

How are compressed pills manufactured? On the small scale, by Remington's compressed pill machine. It is made of cast steel, has at the base two counter-sunk depressions, with a short post in the centre of each, the posts with a lenticular depression in their upper surfaces, two steel cylinders fitting over the posts, plungers that fit in the cylinders with lenticular depressions to correspond with those on the posts. The powder is compressed into pills between the lenticular surfaces by blows on the plungers with a mallet, and the pills are removed by lifting the cylinders. On the large scale by power presses, working on a similar principle.

There are fifteen officinal pills:—

Pilulæ Aloes—2 gr. each aloes and soap. *Aloes et Asafœtidæ*—400 grs. each Aloes, Asafœtida and Soap, in 300 pills. *Aloes et Ferri*—1 gr. each Aloes, Dried Sulph. Iron and Aromat. Powder, q. s. Confect. Rose. *Aloes et Mastiches* [Aloes and Mastic—Lady Webster Dinner Pills]—2 grs. Aloes, ½ gr. each Mastic and Red Rose. *Aloes et Myrrhæ*—2 grs. Aloes, 1 gr. Myrrh, ½ gr. Aromat. Powd., q. s. Syrup. *Antimonii Compositæ* [Plummer's Pills]—½ gr. Sulphurated Ant., ½ gr. Calomel, 1 gr. Guaiac., q. s. Mucilage Tragacanth. *Asafœtidæ*—3 grs. As., 1 gr. Soap. *Catharticæ Compositæ*—1.3 gr. Ext. Col. Comp., 1 gr. each Calomel and Jalap (abstract), ¼ gr. Gamboge. *Ferri Compositæ*—Myrrh 1½ gr.; ¾ gr. each Carb. Sod. and Sulph. Iron, q. s. Syrup. *Ferri Iodidi*—Reduced Iron .6 gr., Iodine 0.8 gr., P. Glycyrr. 0.5 gr., Sugar 0.5 gr., Ext. Glycyrr. 0.12 gr., Acacia 0.12 gr.; q. s. each Water, Bals. Tolu, and Str. Ether. (For process, see U. S. P.) *Galbani Compositæ*—1½ gr. each Gal. and Myrrh, ½ gr. Asafœt., q. s. Syrup. *Opii*—1 gr. Opium, ¼ gr. Soap. *Phosphori*—$\frac{1}{100}$ gr. Phos., 0.8 gr. Althæa, 0.2 gr. Acaciæ: Phosphorus dissolved in ½ gr. Chloroform, and made into a pill with 0.4 gr. Glycerin and 0.2 Water. Coated with ½ gr. Bals. Tolu dissolved in q. s. Str. Ether. *Rhei*—3 grs. Rhubarb and 1 gr. Soap. *Rhei Compositæ*—2 grs. Rhubarb, 1½ gr. Aloes, 1 gr. Myrrh, 0.1 Ol. Pep.

TROCHISCI—TROCHES.

What are Trochisci or Troches? Troches, or lozenges, are solid, discoid or cylindrical masses, consisting chiefly of medicinal powders, sugar and mucilage. They are prepared by making the ingredients into a mass, which is rolled into a thin sheet, and cut into proper shape with a lozenge cutter.

As lozenges are generally made only on the large scale, and by machinery, merely naming them is sufficient here.

There are sixteen officinal lozenges:—

Trochisci Acidi Tannici; Ammonii Chloridi; Catechu; Cretæ; Cubebæ; Ferri; Glycyrrhizæ et Opii ($\frac{1}{20}$ ext. opium in each); *Ipecacuanhæ; Krameriæ; Magnesiæ; Menthæ Piperitæ; Morphinæ et Ipecacuanhæ* ($\frac{1}{20}$ gr. Sulph. Morph. in each); *Potassii Chloratis; Sodii Bicarbonatis; Sodii Santoninatis* (1 gr. Sant. Sod. in each); *Zingiberis.*

SOLID PREPARATIONS FOR EXTERNAL USE.

CERATA—CERATES.

What are Cerata or Cerates? Cerates are unctuous substances of such consistency that they may be easily spread, at ordinary temperatures, upon muslin or similar material, with a spatula, and yet not so soft as to liquefy and run when applied to the skin.

Why are they called cerates? Owing to the presence of wax (Cera).

What substances are used for bases? Oil, lard, petrolatum. Wax, and sometimes paraffin or spermaceti, in the presence of wax, are used to raise the melting point of the bases.

There are eight officinal cerates. Two classes:—

1. OFFICINAL CERATES BY FUSION (6).—*Ceratum*—30 p. W. Wax;

70 p. Lard: Fuse, and stir till cold. *Ceratum Cantharidis*—Yel. Wax 20 p.; Resin 20 p.; Lard 25 p.; Canthar. 35 p.: Digest half an hour; stir till cold. *Cetacei*—Sperm 10 p.; W. Wax 35 p.; Olive Oil 55 p.; Fuse, and stir till cold. *Extracti Cantharidis*—Resin 15 p.; Y. Wax 35 p.; Lard 35 p.: Fuse; digest with Ext. Canthar. 15 p.; strain; stir. *Resinæ*—Resin 35 p.; Yel. Wax 15 p.; Lard 50 p.: Fuse; strain; cool. *Sabinæ*—Resin Cerate 90 p.: Fuse; add Ext. Sabinæ Fld. 25 p.; evaporate alcohol by heat; stir till cold.

2. Officinal Cerates by Incorporation (2).—*Ceratum Camphoræ*—Mix Camph. Lin. 3 p.; Olive Oil 12 p.; Incorporate with Cerate 85 p. *Plumbi Subacetatis*—Incorporate 20 p. Sol. Subacet. Pb into 80 p. Camph. Cerate.

UNGUENTA—OINTMENTS.

What are Unguenta or Ointments? Ointments are fatty preparations, of a softer consistence than cerates, intended to be applied to the skin by inunction.

There are twenty-seven officinal ointments (three classes):—

1. Officinal Ointments by Fusion (5).—*Unguentum*—Lard 80 p.; Yel. Wax 20 p. *Aquæ Rosæ*—Ol. Almonds 50 p.; Sperm. 10 p.; W. Wax 10 p.: Stir, and gradually add Rose Water 30 p. *Diachylon*—Lead Plaster 60 p.; Olive Oil 39 p.: Cool; add Ol. Lav. 1 p.; stir till cold. *Mezerei*—Lard 80 p.; W. Wax 12 p.: Fuse; add Ext. Mez. Fld. 25 p.; stir till alcohol evaporates. *Picis Liquidæ*—Suet 50 p.: Fuse; add Tar 50 p.; strain; stir till cold.

2. Officinal Ointments by Incorporation (21).—*Unguentum Acidi Carbolici*—10 p. Acid; 90 p. Ointment. *Acidi Gallici*—10 p. Acid; 90 p. Benz. Lard. *Acidi Tannici*—10 p. Acid; 90 p. Benz. Lard. *Belladonnæ*—10 p. Alch. Ext. Bellad.; 6 p. Dil. Alcohol (rub till soft); 80 p. Benz. Lard. *Chrysarobini*—10 p. Chrys.; 90 p. Benz. Lard. *Gallæ*—10 p. Galls; 90 p. Benz. Lard. *Hydrargyri*—45 p. Hg; 3 p. Tr. Benz. Comp.; Mix; 10 p. Mercurial Ointment; incorporate; add 22 p. each Lard and Suet, previously melted together and partially cooled: Triturate till globules of Hg cease to be visible under 10 diameters. *Hydrargyri Ammoniati*—10 p. Ammon. Hg; 90 p. Benz. Lard. *Hydrargyri Oxidi Flavi*—10 p. Y. Ox. Hg; 90 p. Ointment. *Hydrargyri Oxidi Rubri*—10 p. Red Ox., Hg: 90 p. Ointment. *Iodi*—4 p. Iodine; 1 p. KI; 2 p. Water; 93 p. Benz. Lard. *Iodoformi*—10 p. Iodoform; 90 p. Benz. Lard. *Plumbi Carbonatis*—10 p. Carb. Pb; 90 p. Benz. Lard. *Plumbi Iodidi*—10 p. Iodide Lead; 90 p. Benz. Lard. *Potassii Iodidi*—12 p. KI: 1 p. Hyposulph. Sodium; 6 p. Boiling W.; Warm Mortar; 81 p. Benz. Lard. *Stramonii*—10 p. Ext. Stram.; 6 p. Water; rub till soft; 85 p. Benz. Lard. *Sulphuris*—30 p. Sub. Sulph.; 70 b. Benz. Lard. *Sulphuris Alkalinum*—20 p. Washed Sulph.; 10 p. Carb. Potass.; 5 p. Water; rub together; 65 p. Benz. Lard. *Veratrinæ*—4 p. Veratrine; 6 p. Alcohol; rub; 96 p. Benz. Lard. *Zinci Oxidi*—20 p. Ox. Zn; 20 p. melted Benz. Lard; Benz. Lard to 100 p.

3. Officinal Ointments by Chemical Reaction (1).—*Unguentum Hydrargyri Nitratis* [Citrine Ointment]—Mercury 6 p.; Nitric Acid 17 p.; Lard Oil 76 p. Heat the lard oil, in a glass or porcelain dish, to 70° C. (158° F.); add, without stirring, 7 p. Nit. Acid; heat till effervescence

discontinues; cool. Dissolve Hg in remaining acid, with q. s. heat; add to above. The olein of the oil is converted into elaidin, through the action of heat and nitric acid; solution of mercuric nitrate is then incorporated with the elaidin base.

EMPLASTRA—PLASTERS.

What are Emplastra, or Plasters? Plasters are substances intended for external application, of such consistence that they adhere to the skin, and require the aid of heat in spreading them.

On what are plasters usually spread? Plasters are usually spread on muslin, leather, paper, etc., and have as a basis, lead plaster, a gum-resin, or Burgundy pitch.

As plasters are usually bought of the manufacturer, ready-made, a description of the process for spreading them is omitted.

There are seventeen officinal plasters. Four classes :—

1. Basis, Gum Resin (4).—*Emplastrum Ammoniaci*—Emuls. 100 p. Ammon. with 140 p. Dil. Acet. Acid by digestion; strain; evaporate until a sample from vessel hardens on cooling. *Ammoniaci cum Hydrargyro*—1 p. Sub. Sulphur; 8 p. heated Olive Oil; stir; triturate in 180 p. Hg; emulsionize 720 p. Ammoniac in 1000 p. Dil. Acet. Acid by digesting, and add; lastly, add q. s. Lead Plaster to 1000 parts. *Asafœtidæ*—Digest 35 p. As.; 15 p. Galbanum; 120 p. Alcohol; strain; evaporate to honey consisteney; add 35 p. Lead Plaster and 15 p. Y. Wax, previously melted; evaporate to proper consistency. *Galbani*—16 p. Gal.; 2 p. Turp.; fuse; 6 p. melted Burgundy Pitch; 76 p. Lead Plaster.

2. Basis, Lead or Resin Plaster (8).—*Emplastrum Arnicæ*—50 p. Ext. Ar. Root; 100 p. Res. Plaster; Melt latter, and incorporate former with it. *Belladonnæ*—Percolate 100 p. Bellad. Root with Alcohol; evaporate at 122° F., to soft extract; incorporate Resin Plaster to 100 p. *Ferri*—70 p. Lead Plaster; 10 p. Can. Turp.; 10 p. Burgundy Pitch; melt; add 10 p. Hyd. Ox. Iron; stir till cool. *Hydrargyri*—10 p. each Olive Oil and Resin: when cool, incorporate 30 p. Mercury; add 50 p. Lead Plaster. *Opii*—Rub 6 p. Ext. Opium; 8 p. Water, until soft; add 18 p. Burg. Pitch; 76 p Lead Plaster, previously melted; heat, and stir to proper consistency. *Plumbi*—Rub, gradually, 32 p. Ox. Pb with 60 p. Olive Oil; add 10 p. Water; boil; adding, cautiously, water from time to time, as it is consumed. *Resinæ*—80 p. Lead Plaster; 6 p. Y. Wax; melt; add Resin 14 p.; mix thoroughly. *Saponis*—10 p. Soap; q. s. water to soft mass; melt 90 p. Lead Plaster; mix.

3. Basis, Burgundy or Canada Pitch (3).—*Emplastrum Picis Burgundicæ*—90 p. B. Pitch; 10 p. Y. Wax. *Picis Canadensis*—90 p. C. Pitch; 10 p. Y. Wax. *Picis cum Cantharide*—8 p. Cerate Canthar.; melt at 212° F.; strain; add 92 p. Burg. Pitch. Melt together and stir.

4. Officinal Spread Plasters (2).—*Emplastrum Capsici*—Spread a thin layer of melted resin plaster on muslin, then apply a thin coating oleoresin capsicum. *Ichthyocollæ*—Distil 10 p. Isinglass in q. s. hot water to 100 p.; spread half on the taffeta with a brush; add 1 p. Glycerin. 40 p. Alcohol to remainder; apply in same manner; coat reverse side with Tr. Benzoin, and dry.

CHARTA—PAPERS.

What are Charta, or Papers? Papers are a small class of preparations intended for external application, made either by saturating paper with medicinal substances, or by applying the latter to the surface of the paper by the addition of some adhesive liquid.

There are three officinal papers:—

Charta Cantharidis—W. Wax 8 p.; Spermaceti 3 p.; Olive Oil 4 p.; Canada Turpentine 1 p.; Water 10 p.; mix, and boil for two hours; strain. Coat strips of sized paper with it, by passing them over the liquid; coat one side only. When cool, cut into rectangular pieces. *Charta Potassii Nitratis*—Nit. Potas. 20 p.; Dist. Water 80 p. Immerse strips of white, unsized paper in the solution, and dry them. *Charta Sinapis*—Black Mustard, Benzine, solution Gutta-percha, of each q. s. Percolate Mustard with Benzine, to rid it of fixed oil; dry. Make semi-liquid with solution gutta-percha. Brush on rather stiff, well-sized paper. Each square inch of paper should contain about 6 grs. mustard.

SUPPOSITORIA—SUPPOSITORIES.

What are Suppositories? Suppositories are solid bodies intended to be introduced into the rectum, urethra, or vagina, to produce medicinal action.

What are the requirements in preparing them? They should be prepared of materials of sufficient consistency to retain their shape when inserted, and, at the same time, melt at the temperature of the body. Butter of cacao fulfills the requirements. Only in the hottest summer weather should its melting point be raised by the addition of spermaceti or wax, unless some softening ingredient is used in making the suppositories.

How are Gelatin Suppositories prepared? Gelatin suppositories are made from a mass containing gelatin and glycerin, by soaking gelatin in water, draining off the excess, adding five parts, by weight, of glycerin to every twelve parts of soft gelatin, and heating in a water-bath. The medicating substance is rubbed into a smooth paste with a small quantity of water or glycerin, and added to the mass.

By what three methods are Suppositories shaped? By *rolling*, *moulding* and *pressing*.

Describe the method for performing each operation.

1. *Rolled Suppositories* are made by incorporating the medicinal substance with grated cacao butter, in a mortar, with a pestle, until the mixture becomes a mass. The mass is now rolled into a cylinder on a pile tile, thoroughly dusted with lycopodium, and cut into the desired lengths, which are then made into a conical form by rolling one end on the tile with a spatula, so as to produce a rounded point.

2. *Moulded Suppositories.*—The U. S. P. directs that they shall be made in the following manner: Mix the medicinal portion (previously brought to a proper consistence, if necessary) with a small quantity of Oil of Theobroma, by rubbing them together, and add the mixture to the remaining Oil of Theobroma, previously melted and cooled to the temperature of 35° C. (95° F.). Then mix thoroughly, without applying more heat, and immediately pour the mixture into suitable moulds. The moulds must be kept cold by being placed on ice. In the absence of suitable moulds, sup-

positories may be formed by allowing the mixture, prepared as above, to cool, care being taken to keep the ingredients well mixed, and dividing into parts of a definite weight each, which may be made into a conical or other convenient form for a suppository. Unless otherwise specified, suppositories shall be made to weigh about fifteen grains, or one gramme.

3. *Pressing.*—This is usually accomplished by pressing the mass through a cylinder into a mould, without heat. Unsatisfactory.

Into what three classes are suppository moulds divided? * Into: 1. Individual moulds. 2. Divided moulds. 3. Hinged moulds.

What are Suppository Capsules? "Dr. F. E. Stewart has suggested the employment of gelatin shells, with conical caps, to be used as suppositories. The medicating ingredients are inserted in the lower portion; the upper margin is then moistened with water, and the cap inserted. Before introducing them into the rectum, they should be wet with sufficient water to enable them to slip in easily."

What are Urethral Suppositories, or Bougies? They are suppositories, usually made of gelatin, in the form of bougies, and used to medicate the mucous surface of the urethra. They may be prepared by melting together 3 p. gelatin, 1 p. glycerin, 1 p. distilled water (by weight), adding the desired medicament, and moulding into cylinders in a well-oiled glass tube, afterwards cutting the cylinder into the desired lengths.

PART III.

THE PREPARATIONS OF THE INORGANIC MATERIA MEDICA.

HYDROGEN, OXYGEN AND WATER.

H; 1. O; 16. H_2O; 18.

Hydrogen and Oxygen are colorless, odorless gases, of no special interest pharmaceutically, except that they combine to form water, which is of the greatest importance in pharmacy. Hydrogen is also unity for quantivalence and atomic weight.

H is combustible; O aids combustion.

AQUA, U. S.—Water.—A colorless, limpid liquid, without odor and taste at ordinary temperatures, and remaining odorless while being heated to boiling, of a perfectly neutral reaction, and containing not more than 1 part of fixed impurities in 10,000 parts.

AQUA DESTILLATA, U. S.—Distilled Water.—A colorless, limpid liquid, without odor or taste, and of a neutral reaction. On evaporating one litre, no fixed residue should remain.

In pharmacy water is used principally as a solvent.

* For excellent descriptions of the various forms of suppository moulds, see Remington's "Practice of Pharmacy."

THE INORGANIC ACIDS.

Acids are distinguished from other bodies by THREE PROPERTIES. 1. They all contain hydrogen, and are sometimes called hydrogen salts. The hydrogen is capable of being replaced by metals. 2. Those which are soluble in water have a characteristic, sour taste, and corrosive action. 3. They act on litmus and other vegetable substances, changing their color.

The inorganic acids may be divided into three classes: 1st. *Hydracids*, or those not containing O, derived from non-metallic elements. Ex., HCl, HBr.. 2d. The O acids from non-metallic elements. Ex., HNO_3, H_2SO_4, H_2SO_3, etc. 3d, *Anhydrides*, from metallic elements. This class includes Arsenious Acid, Chromic Acid, and the weak acid from Boron.

The suffixes "ous" and "ic," are used as terminations to the names of acids containing O; the former denoting a lower proportion of O, the latter a higher amount. Ex., Sulphur*ous* acid, H_2SO_3, contains less O than sulphur*ic* acid, H_2SO_4.

The officinal inorganic acids are mostly solutions of gases in water, the amount of gas in solution varying in the stronger acids; but the officinal class, known as *diluted* acids, are intended to be uniform.

Medical Properties.—Tonic and refrigerant in the dilute form; caustic and corrosive poisons when strong.

Antidotes.—Large amounts of *mild* alkalies administered with some bland, fixed oil. (Soap, carbonate or bicarbonate of sodium, dissolved in water; after which, draughts of oil.)

ACIDUM HYDROCHLORICUM, U. S.—Hydrochloric Acid. Muriatic Acid. HCl.—A colorless, fuming liquid, composed of 31.9 per cent. absolute HCl and 68.1 per cent. water, with a specific gravity 1.16; pungent, suffocating odor; intensely acid taste; strongly acid reaction.

Preparation.—Principally as a by-product in the manufacture of soda-ash, by decomposing NaCl at a high temperature with H_2SO_4. The process has two steps:—

1st Step.—Decomposition of half of the NaCl.

$$\underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Hydrochloric Acid.}}{HCl} + \underset{\text{Sodium Chloride.}}{NaCl} + \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4}.$$

2d Step.—Decomposition remaining NaCl at 220° C. (428 F.), or over.

$$\underset{\text{Sodium Chloride.}}{NaCl} + \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4} = \underset{\text{Hydrochloric Acid.}}{HCl} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4}.$$

The yellow color in common hydrochloric acid is due to organic substances or a trace of iron.

ACIDUM HYDROCHLORICUM DILUTUM, U. S.—Diluted Hydrochloric Acid.—A colorless liquid, containing 10 per cent., by weight, of absolute HCl, and prepared by diluting 6 p. Hydrochloric Acid with 13 p. Distilled Water. Specific gravity 1.049; odorless; strongly acid taste; acid reaction.

ACIDUM HYDROBROMICUM DILUTUM, U. S.—Diluted Hydrobromic Acid. HBr.—A clear, colorless liquid, composed of 10 per cent. absolute HBr and 90 per cent. water. Specific gravity 1.077; odorless; strongly acid taste; acid reaction.

Preparation.—Two methods—1st, distillation; 2d, double decomposition and precipitation.

1st Method (distillation).—Decompose potassium bromide with sulphuric acid. This forms acid potassium sulphate (crystals) and hydrobromic acid (liquid). Separate the liquid HBr from the crystals and distill it in a retort nearly to dryness, then add q. s. distilled water to make the product contain 10 per cent. actual HBr.

$$\underset{\text{Potassium Bromide.}}{KBr} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Acid Potassium Sulphate.}}{KHSO_4} + \underset{\text{Hydrobromic Acid.}}{HBr.}$$

2d Method (precipitation).—Add tartaric acid to a solution of potassium bromide (400 gr. acid to 340 gr. bromide in 4 fl. oz. water). Tartrate of potassium precipitates and HBr remains in solution.

ACIDUM NITRICUM, U. S.—Nitric Acid. HNO_3. *Aqua Fortis.*—A colorless, fuming, very caustic and corrosive liquid, composed of 69.4 per cent. absolute HNO_3 and 30.6 per cent. water; sp. gr. 1.42; peculiar, somewhat suffocating odor; strongly acid reaction.

Preparation.—By acting on Chili Saltpetre (sodium nitrate) with H_2SO_4. If two molecules of $NaNO_3$ and one of H_2SO_4 be taken, the reaction will be as follows:—

Decomposition of 1st molecule $NaNO_3$.

$$\underset{\text{Sodium Nitrate.}}{NaNO_3} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4} + \underset{\text{Nitric Acid.}}{HNO_3.}$$

Then by raising the heat, the $NaHSO_4$ acts upon the second molecule of $NaNO_3$.

Decomposition of 2d molecule $NaNO_3$.

$$\underset{\text{Sodium Nitrate.}}{NaNO_3} + \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Nitric Acid.}}{HNO_3.}$$

There are several varieties of nitric acid in commerce. The officinal acid of 1.42 sp. gr. is termed 43° acid. The ordinary weaker commercial acid of 1.355 sp. gr. is called 38° acid. The reddish acid, known as *nitrous* acid, is nitric acid containing more or less nitrogen tetroxide (N_2O_4). The same acid may be made by impregnating nitric acid with nitrogen dioxide (N_2O_2).

The effect of red heat on nitric acid. It evolves O, as follows:—

$$4HNO_3 + \text{Heat} = (N_2O_4)_2 + O_2 + (H_2O)_2.$$

The great characteristic property of nitric acid. It oxidizes sulphur and phosphorus, giving rise to sulphuric and phosphoric acids, and it oxidizes all the metals with but few exceptions. It is the great oxidizing agent.

ACIDUM NITRICUM DILUTUM, U. S.—Dilute Nitric Acid.—A colorless liquid, containing 10 per cent. absolute HNO_3 (14.3 per cent. officinal nitric acid). Specific gravity 1.059, prepared by diluting 1 p. Nitric Acid with 6 p. Distilled Water.

ACIDUM NITROHYDROCHLORICUM, U. S.—Nitrohydrochloric Acid. *Nitromuriatic Acid. Aqua Regia.*—A golden-yellow, fuming and very corrosive liquid, having a strong odor of Cl, and a strong acid reaction, and containing nitrosyl chloride and free chlorine. It is

made by mixing together 4 p. nitric acid, 15 p. hydrochloric acid in a capacious open glass vessel, and, after effervescence ceases, preserving in a cool, dark place, in glass stoppered bottles, half full.

$$\underset{\text{Nitric Acid.}}{HNO_3} + \underset{\text{Hydrochloric Acid.}}{3HCl} = \underset{\text{Nitrosyl Chloride.}}{NOCl} + \underset{\text{Chlorine.}}{Cl_2} + \underset{\text{Water.}}{2H_2O}.$$

Nitrohydrochloric acid should be kept in a cool, dark place, because it loses Cl by heat, and its Cl is converted into HCl by the action of light and the decomposition of its water.

It is called *Aqua Regia*, because of its power of dissolving gold, the king of metals.

It is indispensable, in keeping and dispensing it, that care should be taken not to confine it until all effervescence ceases, or explosion is likely to occur. And the same care should be exercised in dispensing it in mixtures.

ACIDUM NITROHYDROCHLORICUM DILUTUM, U. S.—Diluted Nitrohydrochloric Acid.—A colorless, or faintly yellow liquid, odorless, or with faint odor of Cl, with a very acid taste and reaction, made by mixing 4 p. nitric acid with 15 p. hydrochloric acid, and after effervescence has entirely ceased, diluting with 76 p. distilled water.

These directions should be literally obeyed, because, unless the acids are mixed while concentrated NOCl and Cl, are not produced.

ACIDUM SULPHURICUM, U. S.—Sulphuric Acid. H_2SO_4. *Oil of Vitriol*—A colorless liquid, of an oily appearance, composed of not less than 96 per cent. absolute H_2SO_4 and not more than 4 per cent. water, and with specific gravity not below 1.840; inodorous; strongly caustic and corrosive; strongly acid reaction.

Sulphuric Acid is prepared by burning S or FeS_2 (iron pyrites) in the air, by which SO_2 is formed. These fumes are conducted into leaden chambers and allowed to mix with steam and nitrous fumes obtained from the decomposition of sodium nitrate. The SO_2 is oxidized into SO_3 by the nitrous fumes containing nitrogen tetroxide (N_2O_4), which gives up part of its O for that purpose. SO_3 then unites with the H_2O (steam) present to form H_2SO_4. The H_2SO_4 condenses on the floor of the leaden chambers and is afterward drawn off and concentrated.

The reactions are as follows: First two molecules of SO_2 react with one molecule of N_2O_4, thus:—

$$\underset{\text{Sulphurous Oxide.}}{2SO_2} + \underset{\text{Nitrogen Tetroxide.}}{N_2O_4} = \underset{\text{Sulphuric Oxide.}}{2SO_3} + \underset{\text{Nitrogen Dioxide.}}{N_2O_2}.$$

In this reaction, N_2O_4 gives up two atoms of its O to $2SO_2$, which becomes $2SO_3$ in consequence, and N_2O_4 is reduced to N_2O_2. Then N_2O_2 goes back to the air for more O, and becomes N_2O_4 again ($N_2O_2 + O_2 = N_2O_4$). The N_2O_4 thus formed gives up its O_2 to fresh portions of $2SO_2$, converting it into $2SO_3$, as before, and this operation is repeated again and again, until all the $2SO_2$ is oxidized into $2SO_3$. During this time the $2SO_3$ that is formed unites with the vapors of H_2O present, and forms H_2SO_4 ($SO_3 + H_2O = H_2SO_4$). The nitrous fumes thus act as an oxygen carrier between sulphur*ous* oxide and the air, and raise the former to sulphur*ic* oxide.

ACIDUM SULPHURICUM AROMATICUM, U. S.—**Elixir of Vitriol.**—An aromatic elixir of sulphuric acid, prepared by mixing together Sulphuric Acid 200 p.; Tr. Ging. 45 p.; Ol. Cinnam. 1 p.; Alcohol to 1000 p.

ACIDUM SULPHURICUM DILUTUM, U. S.—**Diluted Sulphuric Acid.**—A colorless liquid, containing 10 per cent. officinal sulphuric acid, with specific gravity 1.067, and prepared by diluting 1 p. Sulphuric Acid with 9 p. Distilled Water.

ACIDUM SULPHUROSUM, U. S.—**Sulphurous Acid.** H_2SO_3.—A colorless liquid, of a characteristic sulphurous odor and taste, with specific gravity 1.022–23, composed of about 3.5 per cent. of sulphurous acid gas and about 965.5 per cent. of water. It has a characteristic odor of burning sulphur; very acid, sulphurous taste; strongly acid reaction.

Preparation.—By pouring 14 p. H_2SO_4 on 2 p. coarsely powdered charcoal, in a flask connected with a wash-bottle, and a bottle partially filled with 100 p. distilled water. Gentle heat is applied and the gas distilled over. A bottle containing a solution of Na_2CO_3 is provided, to absorb the excess of gas that bubbles up through the distilled water, and the latter is kept cool by placing ice around the bottle, as cold water will absorb more gas than warm water.

Equation for the reaction that occurs:—

$$\underset{\text{Sulphuric Acid.}}{4H_2SO_4} + \underset{\text{Charcoal}}{C_2} = \underset{\text{Sulphurous Acid Gas.}}{4SO_2} + \underset{\text{Carbon Dioxide.}}{2CO_2} + \underset{\text{Water.}}{4H_2O.}$$

ACIDUM PHOSPHORICUM, U. S.—**Phosphoric Acid. Syrupy Phosphoric Acid. Orthophosphoric Acid.** H_3PO_4.—A colorless, syrupy liquid, of specific gravity 1.347, composed of 50 per cent. Orthophosphoric Acid and 50 per cent. of water. Odorless; strongly acid taste; acid reaction.

Preparation.—By distilling phosphorus with nitric acid and distilled water. The phosphorus is oxidized, and, uniting with the water, forms H_3PO_4.

Equation expressing the reaction:—

$$\underset{\text{Phosphorus.}}{12P} + \underset{\text{Nitric Acid.}}{20HNO_3} + \underset{\text{Water.}}{8H_2O} = \underset{\text{Phosphoric Acid.}}{12H_3PO_4} + \underset{\text{Nitrogen Oxide.}}{20NO.}$$

Special directions for preparing this acid are given in the U. S. P. The officinal process was devised to rid the finished product of the impurities, nitric, phosphorous and arsenic acids. Small portions are tested for these impurities (see U. S. P.), which are then disposed of as follows: *Nitric Acid*—evaporate until no reaction for nitric acid can be obtained. *Phosphorous Acid*—add nitric acid and distilled water, and again evaporate until no reaction for phosphorous or nitric acid can be obtained. *Arsenic Acid*—dilute and pass through H_2S, first while hot, then when cold.

The most dangerous impurity, arsenic, is due to the sulphuric acid, made from iron pyrites, which is used in making the phosphorus.

ACIDUM PHOSPHORICUM DILUTUM, U. S.—**Diluted Phosphoric Acid.**—A colorless liquid of specific gravity 1.057, containing 10 per cent. orthophosphoric acid, and prepared by diluting 20 p. of phosphoric acid with 80 p. distilled water.

A precipitate sometimes occurs on mixing this acid with tincture of chloride of iron, generally due to the presence of pyrophosphoric acid. Pyrophosphate of iron is formed as an insoluble gelatinous precipitate.

CHLORINE, BROMINE AND IODINE.

(THE HALOGENS.)

Cl; 35.4 Br; 79.8. I; 126.6.

The four Halogens (salt producers) are *Chlorine*, *Bromine*, *Iodine*, *Fluorine*. The latter is not used in Pharmacy.

CHLORINE—CHLORINE. 35.4.

A greenish-yellow, gaseous body, having a very suffocating odor, and specific gravity 2.45.

AQUA CHLORI, U. S.—Chlorine Water.—A greenish-yellow, clear liquid, having the suffocating odor and disagreeable taste of chlorine, made by passing Cl gas, generated by heating HCl with manganese dioxide, into distilled water until a saturated solution is produced.

Equation for the reaction that occurs:—

$$\underset{\text{Manganese Dioxide.}}{MnO_2} + \underset{\text{Hydrochloric Acid.}}{4HCl} = \underset{\text{Manganese Chloride.}}{MnCl_2} + \underset{\text{Chlorine.}}{Cl_2} + \underset{\text{Water.}}{2H_2O}.$$

Chlorine Water should be secluded from the light, because it is partially converted into HCl by the light, owing to the decomposition of the water, the Cl uniting with the H of the water to form HCl.

Chlorine Water may be made extemporaneously by placing HCl f℥ iij in a pint bottle, adding Potass. Chlor., 40 gr. When the bottle is full of Cl vapor, add 1 fluidounce Distilled Water. Not recommended.

CALX CHLORATA, U. S.—Chlorinated Lime.—A white, or grayish-white, dry, or but slightly damp powder, or friable lumps containing 25 per cent. available chlorine, and prepared by subjecting calcium hydrate, placed on trays in a suitable chamber, to the action of chlorine.

Its chemical formula is probably $CaOCl_2$, yielding, by decomposition with water, calcium hypochlorite and calcium chloride. It is used as a disinfectant and for bleaching purposes, and its usefulness depends on its chlorine, which, being loosely combined, is, therefore, available.

LIQUOR SODÆ CHLORATÆ, U.S.—Solution of Chlorinated Soda. *Labarraque's Solution.*—A clear, pale, greenish liquid, of a faint odor of chlorine, a disagreeable and alkaline taste and an alkaline reaction, made by decomposing solution of chlorinated lime with sodium carbonate, and containing sodium hypochlorite and sodium chloride, calcium carbonate separating out as a precipitate.

Equation expressing the reaction:—

$$\underset{\text{Chlorinated Lime.}}{Ca(OCl)_2} + \underset{\text{Calcium Chloride.}}{CaCl_2} + \underset{\text{Sodium Carbonate.}}{2Na_2CO_3} = \underset{\text{Sodium Hypochlorite.}}{2NaOCl} + \underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Calcium Carbonate.}}{2CaCO_3}.$$

Eau de Javelle (*Javelle Water*), is a French preparation made with K_2CO_3 instead of Na_2CO_3.

BROMUM, U. S.—BROMINE. Br; 79.8.

A dark, brownish-red, mobile liquid, evolving, even at the ordinary temperature, a yellowish-red vapor highly irritating to the eyes and lungs; peculiarly suffocating odor, resembling that of chlorine; prepared by decomposing crude magnesium bromide (bittern) with chlorine gas.

$$\underset{\text{Magnesium Bromide.}}{MgBr_2} + \underset{\text{Chlorine.}}{2Cl} = \underset{\text{Magnesium Chloride.}}{MgCl_2} + \underset{\text{Bromine.}}{2Br.}$$

Bibron's Antidote to Rattlesnake Poison.—Bromine 300 gr.; Dil. Alcohol, f℥viij. Mix. KI 4 gr.; Corros. Sub., 2 gr. Place in a mortar and add q. s. of the solution to dissolve them.

IODUM, U. S.—IODINE. I; 126.6.

Heavy, bluish-black, dry and friable, rhombic plates, of a metallic lustre, distinctive odor, sharp and acid taste, neutral reaction, formerly obtained exclusively from the ashes of seaweed (kelp), but now made from the mother liquor obtained from the crystallization of sodium nitrate in South America, in which it occurs in the forms of sodium iodide and iodate.

Preparation.—The iodides are decomposed by Cl, iodine being set free, whilst the iodine from the iodates is precipitated by acid sodium sulphite. *Kelp* contains iodine in the form of NaI. The solution from it is treated with H_2SO_4 and distilled with MnO_2. The I condenses in glass receivers.

$$\underset{\text{Sodium Iodide.}}{2NaI} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Manganese Dioxide.}}{MnO_2} = \underset{\text{Iodine.}}{I_2} + \underset{\text{Manganese Sulphate.}}{MnSO_4} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Water.}}{2H_2O.}$$

The U. S. P. preparations of Iodine: *Iodum, Tinctura, Iodi, Liquor Iodi Compositus, Unguentum Iodi, Amylum Iodatum, Syrupus Acidi Hydriodici.*

AMYLUM IODATUM, U. S.—Iodized Starch.—Take of Starch 95. p.; Iodine 5 p.; Distilled Water, to make 100 p. Triturate the Iodine with a little Distilled Water, add the Starch gradually, and continue the triturating until the compound assumes a uniform blue color, approaching black. Dry it at a temperature not exceeding 40° C. (104° F.), and rub it to a fine powder.

SYRUPUS ACIDI HYDRIODICI, U. S.—Syrup of Hydriodic Acid.—A syrupy liquid, containing 1 per cent. of absolute Hydriodic Acid, having the specific gravity 1.300, and is made by adding an alcoholic solution of Iodine to Syrup, and passing through the mixture Hydrosulphuric Acid gas until the color of Iodine is discharged. The H_2S is disposed of by evaporation. When cold, it is flavored with spirit of orange, and more sugar added.

Equation showing the reaction that occurs when H_2S is passed into a solution containing Iodine:—

$$\underset{\text{Iodine.}}{4I} + \underset{\text{Hydrosulphuric Acid.}}{2H_2S} = \underset{\text{Hydriodic Acid.}}{4HI} + \underset{\text{Sulphur.}}{2S.}$$

SULPHUR AND PHOSPHORUS.

S; 32. P; 31.

SULPHUR. S; 32.

Sulphur occurs uncombined in Sicily and in other parts of the world, and is widely diffused in the form of sulphates and sulphides.

Roll-sulphur is prepared by fusing sulphur, permitting it to stand, to separate impurities, and then pouring into cylindrical moulds.

Three forms of sulphur are officinal: *sublimed*, *washed* and *precipitated* sulphur.

HYDROSULPHURIC ACID.—Sulphuretted Hydrogen.—An offensive gas formed by the combination of two parts hydrogen with one part sulphur, H_2S, also known as *hydrogen sulphide*. It is made by acting on ferrous sulphide with dilute sulphuric acid, and is used for testing the presence of metals, with which it forms characteristic precipitates.

SULPHUR SUBLIMATUM, U. S.—Flowers of Sulphur.—A fine, citron-yellow powder, of a slight characteristic odor, and generally of a faintly-acid taste, made by conducting the vapor of sulphur into a cool chamber, where it condenses in the form of crystalline powder.

SULPHUR LOTUM, U. S.—Washed Sulphur.—A fine, citron-yellow powder, odorless and almost tasteless, made by washing sublimed sulphur with water containing ammonia, to rid it of sulphuric acid and other impurities.

SULPHUR PRÆCIPITATUM, U. S.—Precipitated Sulphur.—A very fine, yellowish-white, amorphous powder, odorless and almost tasteless, made by precipitating a solution of calcium disulphide with hydrochloric acid.

Calcium disulphide is prepared by boiling unslaked lime with sublimed sulphur, cooling, and filtering off the clear solution of calcium disulphide, which is then precipitated with HCl.

Equations describing the reactions that occur:—

1st. The lime and sulphur react to form calcium disulphide and calcium thiosulphate (hyposulphite).

$$\underset{\text{Calcium Oxide.}}{3CaO} + \underset{\text{Sulphur.}}{6S} = \underset{\text{Calcium Disulphide.}}{2CaS_2} + \underset{\text{Calcium Thiosulphate.}}{CaS_2O_3}.$$

2d. HCl is added, which precipitates the sulphur.

$$\underset{\text{Calcium Disulphide.}}{2CaS_2} + \underset{\text{Calcium Thiosulphate.}}{CaS_2O_3} + \underset{\text{Hydrochloric Acid.}}{6HCl} = \underset{\text{Calcium Chloride.}}{3CaCl_2} + \underset{\text{Sulphur.}}{6S} + \underset{\text{Water.}}{3H_2O}.$$

Lac Sulphuris, or Milk of Sulphur.—In some processes, H_2SO_4 is used instead of HCl. This precipitates calcium sulphate with sulphur, giving it a milky color. It is an inferior product.

SULPHURIS IODIDUM, U. S.—Iodide of Sulphur.—A grayish black solid, generally in pieces, having a radiated, crystalline appearance, with a characteristic odor of iodine; somewhat acrid taste; faintly acid reaction; made by heating 1 p. sulphur with 4 p. iodine. It is also known as *subiodide* of *sulphur*, or *iodine disulphide* (?), S_2I_2.

CARBONEI BISULPHIDUM, U. S.—Bisulphide of Carbon (*Disulphide of Carbon.*)—A clear, colorless, very diffusive, highly refractive

liquid, with strong characteristic odor, and sharp aromatic taste; neutral. Specific gravity 1.272. Made by the direct combination of carbon and sulphur at a moderate red heat.

Preparation.—Charcoal is heated to redness, in a vertical cylinder provided with a lateral tubulure near the bottom, through which sulphur is admitted. The sulphur melts, volatilizes, and unites with the carbon, forming carbon bisulphide. This distills over and condenses in tubes, which collect it while allowing the H_2S formed at the same time to escape. It is then purified by agitation with mercury, and distillation in contact with white wax. By repeated rectification it can be made odorless. Used principally as a solvent. Best solvent for rubber, etc.

The officinal preparations of sulphur are: *Unguentum Sulphuris*—made by mixing 30 p. Sub. Sulph. with 70 p. Benz. Lard. *Unguentum Sulphuris Alkalinum*—20 p. Washed S.; 10 p. K_2CO_3; 5 p. Water; 65 p. Benz. Lard.

PHOSPHORUS. P; 31.

A translucent, nearly colorless solid, of a waxy lustre, having, at the ordinary temperature, about the consistence of beeswax, and with a distinctive, disagreeable odor and taste. It is prepared by deoxidizing phosphoric acid with carbon. This is accomplished by heating acid calcium phosphate, obtained by treating calcium phosphate with sulphuric acid, with charcoal.

$Ca_3(PO_4)_2$	+	$2H_2SO_4$	=	$CaH_4(PO_4)_2$	+	$2CaSO_4$.
Calcium Phosphate.		Sulphuric Acid.		Acid Calcium Phosphate.		Calcium Sulphate.

The process is conducted in a retort. Carbon, at a high temperature, takes oxygen from the phosphoric acid, and becomes carbonic acid. Phosphorus and carbonic oxide distill over, and the former is condensed in water, while the latter escapes.

Red Phosphorus.—A non luminous, non-poisonous, red amorphous powder, consisting of phosphorus in one of its allotropic forms, prepared by allowing phosphorus to remain in an atmosphere of carbon dioxide for several days, at a temperature ranging from 215° to 250° C. (419°–482° F.). By heating it to 280° C. (536° F.), it is converted into ordinary phosphorus.

The three oxides formed by phosphorus are: Phosphoric Oxide, $P_2^{v}O_5^{ii}$; Phosphorous Oxide, $P_2^{iii}O_3^{ii}$; and Hypophosphorous Oxide (?), $P_2^{i}O^{ii}$.

The three corresponding acids are: Orthophosphoric Acid (tribasic acid), H_3PO_4; Pyrophosphoric Acid, $H_4P_2O_7$; and Metaphosphoric Acid, HPO_3.

These acids are prepared as follows: Orthophosphoric Acid—by dissolving P_2O_5 in boiling water ($P_2O_5 + 3H_2O = 2H_3PO_4$). Pyrophosphoric Acid—by heating orthophosphoric acid to 213° C. (415° F.). Metaphosphoric Acid—by igniting orthophosphoric acid.

Orthophosphoric acid may also be made by acting on P with HNO_3. Metaphosphoric acid may also be prepared by dissolving P_2O_5 in cold water.

The officinal Acidum Phosphoricum is the orthophosphoric acid.

There are two other phosphoric acids: Phosphorous acid, H_3PO_3 (dibasic, containing one H atom not replaceable by a metal); and Hypo-

phosphorous Acid, H_3PO_2 (monobasic, containing two H atoms not replaceable by a metal). These acids cannot be produced directly from their corresponding oxides, Phosphorous Oxide, P_2O_3, and Hypophosphorous Oxide, P_2O.

Preparations of phosphorus, officinal: Phosphorus itself, Oleum Phosphoratum (1 p. P in Ol. Amygd. Dulc.), and Pilulæ Phosphori. (See Part II.)

CARBON, BORON AND SILICON.

C; 12. B; 11. Si; 28.

CARBON. C; 12.

Carbon is a constituent of all organic substances, and found in nature in the forms of coal, plumbago, diamond, etc.

The two oxides of carbon and their corresponding acids are, carbon dioxide, CO_2, and carbonic acid, H_2CO_3 ($CO_2 + H_2O = H_2CO_3$), carbon monoxide, CO, which is of little interest in pharmacy.

Carbon Dioxide.—A colorless, odorless gas, with slightly acid taste, heavier than air, incombustible and a non supporter of combustion. Water absorbs its own volume of it at ordinary temperatures and pressure, and many times its volume under cold and pressure.

Aqua Acidi Carbonici, or "Soda Water." A solution of carbon dioxide in water made under pressure, and dispensed under the well-known name, "Soda Water." It was formerly officinal.

CARBO ANIMALIS, U. S—Animal Charcoal. *Bone Black, or Ivory Black.*—Dull-black, granular fragments, or a dull-black powder, odorless and nearly tasteless, prepared by subjecting bones to a red heat in close vessels.

Preparation.—Bones consist of calcium phosphate and carbonate with animal matter. In the destructive distillation, which is conducted in iron cylinders without access of air, the N and H of the animal matter unite to form NH_4, which distills over, leaving most of the C behind with the calcium salts.

Bone Spirit and Bone Oil.—The ammoniacal liquor and dark tarry liquid that distill over, are known as bone spirit and bone oil, respectively.

CARBO ANIMALIS PURIFICATUS, U. S.—Purified Animal Charcoal.—Animal charcoal purified from calcium salts by HCl.

CARBO LIGNI, U. S.—Charcoal.—Prepared by burning wood out of contact with the air, whereby its volatile portions, hydrogen, oxygen, water, etc., are dissipated, carbon, mixed with mineral salts, being left.

BORON. B; 11.

Boron exists in three allotropic forms, amorphous, crystalline and graphitoidal (same as carbon).

The result of its combination with O and H is Boric (Boracic) Acid, H_3BO_3.

ACIDUM BORICUM, U. S.—Boric Acid. *Boracic Acid.* H_3BO_3. —Is obtained in the lagoons in Tuscany; in California lakes, etc., in the

forms of boric acid and borate of sodium (borax). Boric acid is made by decomposing borax with HCl :—

$$\underset{\text{Sodium Borate.}}{Na_2B_4O_7{\cdot}10H_2O} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid.}}}{2HCl} = \underset{\substack{\text{Sodium}\\ \text{Chloride.}}}{2NaCl} + \underset{\substack{\text{Boric}\\ \text{Acid.}}}{4H_3BO_3} + \underset{\text{Water.}}{5H_2O.}$$

Acidum Boricum occurs in the form of transparent, colorless, six-sided plates, slightly unctuous to the touch, permanent in the air. Odorless; cooling, bitterish taste, freely acid in solution.

SILICON. Si; 28.

Silicon exists in three allotropic forms, amorphous, crystalline and graphitoidal.

It is found in combination with Al, Mg, and Ca, in pumice, meerschaum, asbestos, etc., and as an anhydride (silica) in sand, flint, quartz, etc.

SILICA, SiO_2.—**Silicon Anhydride.**—Is obtained in a pure condition by treating the officinal solution of silicate of sodium with HCl :—

$$\underset{\substack{\text{Sodium}\\ \text{Silicate.}}}{Na_2SiO_3} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid.}}}{2HCl} = \underset{\text{Silica.}}{SiO_2} + \underset{\substack{\text{Sodium}\\ \text{Chloride.}}}{2NaCl} + \underset{\text{Water.}}{H_2O.}$$

LIQUOR SODII SILICATIS, U. S.—(Na_2SiO_3). **Soluble Glass.**—A semi-transparent, almost colorless, or yellowish, or pale-greenish yellow, viscid liquid, specific gravity 1.3 or 1.4. Odorless; sharp, saline and alkaline taste; alkaline reaction. Made by fusing 1 p. fine sand (silica) with 2 p. dried sodium carbonate, and dissolving the product.

Used in surgery to prepare mechanical dressings.

POTASSIUM, SODIUM, LITHIUM AND AMMONIUM.

K; 39. Na; 23. Li; 7. NH_4; 18.

Alkali-metals and their Characteristics.—The alkaline metals are Potassium, Sodium and Lithium. They are characterized, 1, by their silvery-white appearance; 2, softness; 3, powerful affinity for oxygen; 4, lightness, being lighter than water, on which they float and take fire spontaneously, owing to their power of decomposing that fluid. They are all univalent.

The metals may be obtained by exposing their carbonates, mixed with charcoal, to an intense heat, carbon monoxide being liberated, and the vaporized metals condensed in appropriate receivers.

Ammonium is a compound radicle, consisting of NH_4, but, owing to its many analogies with the alkali-metals, classed with them.

Characteristics of Alkalies.—1. They combine with acids to form salts. 2. They restore the color of reddened litmus, turn vegetable blues to green, and yellow to brown. 3. Their taste is characteristic, and if concentrated, caustic.

POTASSIUM.

Sources of the Potassium Salts.—Formerly, wood ashes; now, the principal source is an impure chloride from the Stassfurt mines, in Germany.

Lye, Potash and *Pearlash.*—When wood is burned to ashes, the salts of

potassium contained therein are converted into *carbonates*. Wood ashes are placed in a conical wooden vessel, termed a *leach*, and water allowed to percolate through, which becomes impregnated with the potassium carbonate contained in the ashes, and the solution is called *lye*. By evaporating lye to dryness in an iron pot, a solid remains, consisting principally of impure carbonate, which is called *potash*. Potash, calcined on the hearth of a reverberating furnace, loses its water and becomes white. It is then known as *pearlash*, and is an impure carbonate of potassium.

POTASSA, U. S.—Caustic Potash. KHO; 56.—A white, hard and dry solid, generally in form of pencils; very deliquescent; odorless or having a faint odor of lye; very acrid and caustic taste; strongly alkaline reaction. Prepared from wood ashes by lixiviating, evaporating, purifying, redissolving, treating with lime, evaporating, fusing and casting into moulds.

$$\underset{\text{Potassium Carbonate}}{K_2CO_3} + \underset{\text{Calcium Hydrate.}}{Ca2HO} = \underset{\text{Potassium Hydrate.}}{2KHO} + \underset{\text{Calcium Carbonate.}}{CaCO_3}.$$

POTASSA CUM CALCE, U. S.—Potassa with Lime.—A grayish-white powder, deliquescent, strongly alkaline, made by mixing together equal parts well-dried potassa and lime.

LIQUOR POTASSÆ, U. S.—Solution of Potassa.—An aqueous solution of hydrate of potassium, containing about 5 per cent. of the hydrate; clear and colorless; odorless; with very acrid and caustic taste; strongly alkaline reaction. Made by decomposing potassium bicarbonate through the action of calcium hydrate and heat, or by dissolving the hydrate in water.

POTASSA SULPHURATA, U. S.—Sulphurated Potash. *Liver of Sulphur.*—An indefinite chemical compound, occurring in irregular pieces, of a liver-brown color when freshly prepared, turning gradually to greenish-yellow or brownish-yellow, with a faint, disagreeable odor and bitter, alkaline, repulsive taste; alkaline reaction. Made by melting potassa and sulphur together in a crucible, pouring the liquid on a slab, and cooling.

$$3K_2CO_3 + 4S_2 = 2K_2S_3 + K_2S_2O_3 + 3CO_2.$$

POTASSII ACETAS, U. S.—Acetate of Potassium. $KC_2H_3O_2$ 98.—White, foliaceous, satiny, crystalline masses, or a white, granular powder; very deliquescent; odorless; warming, mildly pungent and saline taste; neutral or faintly alkaline reaction. Made by decomposing potassium bicarbonate with acetic acid, filtering and evaporating, carefully avoiding contact with iron.

$$\underset{\text{Potassium Bicarbonate.}}{KHCO_3} + \underset{\text{Acetic Acid.}}{HC_2H_3O_2} = \underset{\text{Potassium Acetate.}}{KC_2H_3O_2} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

POTASSII BICARBONAS, U. S.—Bicarbonate of Potassium. $KHCO_3$; 100.—Colorless, transparent, monoclinic prisms, permanent in dry air; odorless; saline and slightly alkaline taste; feebly alkaline reaction. Made by passing carbon dioxide into a solution of carbonate, evaporating and crystallizing.

$$\underset{\text{Potassium Carbonate.}}{K_2CO_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\text{Potassium Bicarbonate.}}{2KHCO_3}.$$

POTASSII BICHROMAS, U. S.—**Bichromate of Potassium.** $K_2Cr_2O_7$; 294.8.—Large, orange-red, transparent, four-sided tabular prisms, permanent in the air; odorless; bitter, disagreeable, metallic taste; acid reaction; made by treating potassium chromate, prepared from *chrome iron ore*, with sulphuric acid, evaporating and crystallizing.

The ore is heated with potassium carbonate and chalk in contact with air, and the following reaction takes place:—

$$\underset{\text{Chrome Iron Ore.}}{2(FeOCr_2O_3)} + \underset{\text{Potassium Carbonate.}}{4K_2CO_3} + \underset{\text{Oxygen.}}{7O} =$$

$$\underset{\text{Potassium Chromate.}}{4(K_2CrO_4)} + \underset{\text{Ferric Oxide.}}{Fe_2O_3} + \underset{\text{Carbon Dioxide.}}{4CO_2};$$

Then—

$$2(K_2CrO_4) + H_2SO_4 = K_2Cr_2O_7 + K_2SO_4 + H_2O.$$

POTASSII BITARTRAS, U. S.—**Bitartrate of Potassium.** $KHC_4H_4O_6$; 188. (*Cream of Tartar.*)—Colorless, or slightly opaque, rhombic crystals, or a white, somewhat gritty powder; permanent in the air; odorless; pleasant, acidulous taste; acid reaction. Made by purifying *argols*, the sediment deposited in wine casks during fermentation.

POTASSII BROMIDUM, U. S.—**Bromide of Potassium.** KBr; 118.8.—Colorless, translucent, cubical crystals; permanent in dry air; generally appearing in commerce in white, opaque or semi-transparent crystals, having a faint alkaline reaction; odorless, pungent, saline taste; neutral reaction. Made by treating solution of potassa with bromine and charcoal.

The rationale of the process is as follows: Bromine added to solution potassa forms *bromide* and *bromate*. The solution is evaporated to dryness, and heated with charcoal, which deoxidizes the bromate, CO escaping.

$$\underset{\text{Potassium Bromate.}}{2KBrO_3} + \underset{\text{Carbon.}}{3C_2} = \underset{\text{Potassium Bromide.}}{2KBr} + \underset{\text{Carbon Monoxide.}}{6CO}.$$

POTASSII CARBONAS, U. S.—**Carbonate of Potassium.** $(K_2CO_3)_2.3H_2O$; 330. (*Sal Tartar*).—A white, crystalline or granular powder, very deliquescent at 15° C. (59° F.); odorless; strongly alkaline taste; alkaline reaction. Made by purifying pearlash, by dissolving it in *cold* water, filtering, evaporating, and granulating.

POTASSII CHLORAS, U. S.—**Chlorate of Potassium.** $KClO_3$; 122.4.—Colorless, monoclinic prisms or plates, of a pearly lustre, permanent in the air; odorless; cooling, saline taste; neutral reaction. Made by reacting on potassium chloride with calcium hypochlorite.

The rationale of the process is as follows: When solution of calcium hypochlorite is boiled, it is decomposed into calcium chlorate and chloride; and when calcium chlorate is heated with potassium chloride, double decomposition forms potassium chlorate and calcium chloride.

1st. $$\underset{\text{Calcium Hypochlorite.}}{3Ca(OCl)_2} + \text{boiling} = \underset{\text{Calcium Chloride.}}{2CaCl_2} + \underset{\text{Calcium Chlorate.}}{Ca(O_3Cl)_2}.$$

2d. $$\underset{\text{Calcium Chlorate.}}{Ca(O_3Cl)_2} + \underset{\text{Potassium Chloride.}}{2KCl} = \underset{\text{Potassium Chlorate.}}{2KClO_3} + \underset{\text{Calcium Chloride.}}{CaCl_2}.$$

POTASSII CITRAS, U. S.—Citrate of Potassium. $K_3C_6H_5O_7.H_2O$; 324.—A white, granular powder, deliquescent on exposure to air; odorless; slightly cooling, faintly alkaline taste; neutral or faintly alkaline reaction. Made by decomposing potassium bicarbonate with citric acid, filtering, evaporating, and granulating.

$$\underset{\text{Potassium Bicarbonate.}}{3KHCO_3} + \underset{\text{Citric Acid.}}{H_3C_6H_5O_7} = \underset{\text{Potassium Citrate.}}{K_3C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon Dioxide.}}{3CO_2}.$$

POTASSII CYANIDUM, U. S.—Cyanide of Potassium. KCN; 65.—White, opaque, amorphous pieces, or a white, granular powder, deliquescent in damp air; colorless when perfectly dry, but generally of a peculiar, characteristic odor; sharp, somewhat alkaline and bitter-almond taste; strongly alkaline reaction. Made by fusing potassium ferrocyanide with potassium carbonate, separating the insoluble precipitate of metallic iron, and pouring the fused mass on a slab.

$$\underset{\text{Potassium Ferrocyanide.}}{K_4Fe(CN)_6} + \underset{\text{Potassium Carbonate.}}{K_2CO_3} = \underset{\text{Potassium Cyanide.}}{5KCN} + \underset{\text{Potassium Cyanate.}}{KOCN} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Metallic Iron.}}{Fe}.$$

POTASSII ET SODII TARTRAS, U. S.—Tartrate of Potassium and Sodium. *Rochelle Salt.* $KNaC_4H_4O_6.4H_2O$; 282.—Colorless, transparent, rhombic crystals, slightly efflorescent in dry air, or a white powder; odorless; cooling, mildly saline and slightly bitter taste; neutral reaction. Made by treating solution of potassium bitartrate with sodium carbonate.

$$\underset{\text{Potassium Bitartrate.}}{2KHC_4H_4O_6} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Potassium and Sodium Tartrate.}}{2KNaC_4H_4O_6} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

POTASSII FERROCYANIDUM, U. S.—Ferrocyanide of Potassium. $K_4Fe(CN_6.3H_2O$; 421.9.—Large, coherent, lemon-yellow, translucent and rather soft, four-sided prisms or tablets, slightly efflorescent in dry air; odorless; sweetish and saline taste; neutral reaction. Made by treating nitrogenized substances (refuse animal matter) with crude pearlash, by which impure potassium cyanide is formed, lixiviating, and treating with freshly-precipitated ferrous carbonate, which produces ferrocyanide of potassium, by the following reaction:—

$$\underset{\text{Potassium Cyanide.}}{6KCN} + \underset{\text{Ferrous Carbonate.}}{FeCO_3} = \underset{\text{Potassium Ferrocyanide.}}{K_4Fe(CN)_6} + \underset{\text{Potassium Carbonate.}}{K_2CO_3}.$$

POTASSII HYPOPHOSPHIS, U. S.—Hypophosphite of Potassium. KH_2PO_2; 104.—White, opaque, confused, crystalline masses, or a white, granular powder, very deliquescent; odorless; sharp, saline, slightly bitter taste; neutral reaction. Made by precipitating calcium hypophosphite with potassium carbonate, filtering, evaporating and granulating, keeping it below 100° C. (212° F.) during the operation, for fear of explosion.

$$\underset{\text{Calcium Hypophosphite.}}{Ca2H_2PO_2} + \underset{\text{Potassium Carbonate.}}{K_2CO_3} = \underset{\text{Potassium Hypophosphite.}}{2KH_2PO_2} + \underset{\text{Calcium Carbonate.}}{CaCO_2}.$$

POTASSII IODIUM, U. S.—Iodide of Potassium. KI; 165.6.—Colorless, translucent, cubical crystals, slightly deliquescent. The com-

mercial salt generally appears in white, opaque crystals, having a faintly alkaline reaction: but single crystals laid upon moistened red litmus paper should not at once produce a violent blue stain (absence of more than one-tenth per cent. of alkali). At a dull red heat the salt melts without losing weight. Of a peculiar faint odor, pungent, saline, afterward somewhat bitter, taste; neutral reaction. Made by treating solution of potassa with iodine, evaporating to dryness and heating with charcoal. The result is, the formation of two salts, Iodide and Iodate of Potassium:—

$$\underset{\text{Potassium Hydrate.}}{6KOH} + \underset{\text{Iodine.}}{(I_2)_3} = \underset{\text{Potassium Iodide.}}{5KI} + \underset{\text{Potassium Iodate.}}{KIO_3} + \underset{\text{Water.}}{3H_2O}.$$

By evaporating to dryness, the mixed salts are obtained, and by exposing to heat with charcoal, the iodate is deoxidized to iodide.

POTASSII NITRAS, U. S.—Nitrate of Potassium. KNO_3; 101.—Colorless, transparent, six-sided rhombic prisms, or a crystalline powder, permanent in the air. Odorless, cooling, saline and pungent taste. Neutral reaction. Usually a natural product; produced artificially, however, in what are known as *nitre beds*, consisting of earth, wood-ashes, animal and vegetable refuse. Ammonia is produced by decomposition, is oxidized and nitric acid formed, which unites with the potassa in the ashes and potassium nitrate results. This is separated by lixiviation, filtration, evaporation and crystallization. It is commonly called Nitre or Saltpetre.

POTASSII PERMANGANAS, U. S.—Permanganate of Potassium. $K_2Mn_2O_8$; 314.—Deep, purple-violet or nearly black, needle-shaped, rhombic prisms, of a metallic lustre, permanent in the air. Odorless, sweet, afterward disagreeable, astringent taste; neutral reaction. Made by heating together manganese dioxide, potassium chlorate and potassa.

The rationale of the reaction is as follows: The salts are mixed together and heated in a crucible, which results in a semi-fused mass, this is boiled with water and neutralized with dilute sulphuric acid, evaporated and crystallized. By this process, potassium chlorate yields oxygen to manganese dioxide, converting it into manganic acid, which unites with the potassa to form the manganate, potassium chloride being formed at the same time.

$$\underset{\text{Manganese Dioxide.}}{3MnO_2} + \underset{\text{Potassium Hydrate.}}{6KHO} + \underset{\text{Potassium Chlorate.}}{KClO_3} = \underset{\text{Potassium Manganate.}}{3K_2MnO_4} + \underset{\text{Potassium Chloride.}}{KCl} + \underset{\text{Water.}}{3H_2O}.$$

The potassium manganate is converted to potassium permanganate when the solution is boiled with water, as follows:—

$$\underset{\text{Potassium Manganate.}}{3K_2MnO_4} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Potassium Permanganate.}}{K_2Mn_2O_8} + \underset{\text{Manganese Peroxide.}}{MnO_3H_2} + \underset{\text{Potassium Hydrate.}}{4KHO}.$$

The acid is used to neutralize the potassium hydrate liberated by the reaction, for in the presence of an excess of potassa, the permanganate otherwise remains in the condition of manganate.

POTASSII SULPHAS, U. S.—Sulphate of Potassium. K_2SO_4; 174.—Colorless, hard, six-sided, rhombic prisms, permanent in the air; odorless; sharp, saline, slightly bitter taste; neutral reaction. Made by purifying the residue from nitric acid manufacture, also from other sources,

as *Kainite*, the mineral found in the Stassfurt salt-beds, which is a double sulphate of potassium and magnesium.

It may be made directly, at any time, by decomposing potassium nitrate with sulphuric acid.

$$\underset{\text{Potassium Nitrate.}}{2KNO_3} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Potassium Sulphate.}}{K_2SO_4} + \underset{\text{Nitric Acid.}}{2HNO_3}.$$

POTASSII SULPHIS, U. S. — **Sulphite of Potassium.** $K_2SO_3.2H_2O$; 194.—White, opaque, obliquely rhombic, octahedral crystals, or a crystalline powder, somewhat deliquescent. Odorless, bitter, saline and sulphurous taste; neutral or feebly alkaline reaction. Made by passing sulphurous acid gas through a solution of potassium carbonate, evaporating and crystallizing.

$$\underset{\text{Potassium Carbonate.}}{K_2CO_3} + \underset{\text{Sulphurous Acid.}}{SO_2} = \underset{\text{Potassium Sulphite.}}{K_2SO_3} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

POTASSII TARTRAS, U. S.—**Tartrate of Potassium.** $(K_2C_4H_4O_6)_2.H_2O$; 470.—Small, transparent, or white, monoclinic crystals, or a white powder, somewhat deliquescent. Odorless, saline, slightly bitter taste; neutral reaction. Made by treating solution of potassium bitartrate with potassium carbonate.

$$\underset{\text{Acid Potassium Tartrate.}}{2KHC_4H_4O_6} + \underset{\text{Potassium Carbonate.}}{K_2CO_3} = \underset{\text{Potassium Tartrate.}}{2K_2C_4H_4O_6} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

The precipitate which is formed is calcium tartrate, always found in potassium bitartrate. It must be filtered out.

LIQUOR POTASSII CITRATIS, U. S.—Solution of Citrate of Potassium.—Potass. Bicarb., 8 p.; Citric Acid, 6 p.; in 100 p. Water.

MISTURA POTASSII CITRATIS, U. S.—Mixture of Citrate of Potassium. (*Neutral Mixture.*)—Potass. Bicarb., 10 p.; Lemon Juice, 100 p.

LIQUOR POTASSII ARSENITIS, U. S.—Solution of Arsenite of Potassium. *Fowler's Solution.*—Made by boiling Potass. Bicarb. with Arsenious Acid and adding Tr. Lav. Comp.

TROCHISCI POTASSII CHLORAS, U. S.—Troches of Chlorate of Potassium.—5 Gr. Troches.

SODIUM.

The Salts of Sodium are generally more frequently used than those of Potassium, because they are relatively and often more soluble.

SODA, U. S.—Soda. NaHO; 40.—A white, hard, opaque solid, generally in the form of fibrous pieces, or of white, cylindrical pencils, deliquescent in moist air, but in dry air becoming dry and efflorescent; odorless; intensely acrid and caustic taste; strongly alkaline reaction. Made by boiling solution of sodium carbonate with calcium hydrate and evaporating. Commercial Name—Caustic Soda.

LIQUOR SODÆ, U. S.—Solution of Soda.—A clear, colorless liquid, consisting of hydrate of sodium (NaHO) about 5 per cent.; odor-

less; very acrid and caustic taste; strongly alkaline reaction. Made by decomposing the carbonate by heating it in contact with an aqueous mixture of calcium hydrate, or by dissolving NaHO in water.

LIQUOR SODÆ CHLORATÆ, U. S. – Solution of Chlorinated Soda.—Made by double decomposition between Chlorinated Lime and Sodium Carbonate. (See Chlorine.)

SODII ACETAS, U. S.—Acetate of Sodium. $NaC_2H_3O_2.3H_2O$; 136.—Large, colorless, transparent, monoclinic prisms; efflorescent in dry air; odorless; saline, bitter taste; neutral or faintly alkaline reaction. Made by decomposing sodium carbonate with acetic acid.

$$\underset{\text{Acetic Acid.}}{2HC_2H_3O_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Acetate.}}{2NaC_2H_3O_2} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

SODII ARSENIAS, U. S.—Arseniate of Sodium. $Na_2HAsO_4.7H_2O$; 311.9.—Colorless, transparent, prismatic crystals; slightly efflorescent in dry air; odorless; mild, feebly alkaline taste; faintly alkaline reaction. Made by heating together arsenious acid, sodium nitrate and sodium carbonate.

The rationale of this process is, that when these three salts are fused together, sodium pyroarseniate is formed, while nitrous anhydride and carbon dioxide escape as gases.

$$\underset{\text{Arsenious Acid.}}{As_2O_3} + \underset{\text{Sodium Nitrate.}}{2NaNO_3} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Pyroarseniate.}}{Na_4As_2O_7} + \underset{\text{Nitrous Anhydride.}}{N_2O_3} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

The sodium pyroarseniate is then converted into orthoarseniate by dissolving the former in water, filtering and crystallizing. The orthoarseniate is the officinal salt.

$$\underset{\text{Sodium Pyroarseniate.}}{Na_4As_2O_7} + \underset{\text{Water.}}{15H_2O} = \underset{\text{Sodium Orthoarseniate.}}{2(Na_2HAsO_4,7H_2O)}.$$

SODII BENZOAS, U. S.—Benzoate of Sodium. $NaC_7H_5O_2.H_2O$; 162.—A white, semi crystalline or amorphous powder; efflorescent on exposure to air; odorless, or having a faint odor of benzoin; sweetly-astringent taste, free from bitterness; neutral reaction. Made by decomposing sodium carbonate with benzoic acid.

$$\underset{\text{Benzoic Acid.}}{2HC_7H_5O_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Benzoate.}}{2NaC_7H_5O_2} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

SODII BICARBONAS, U. S.—Bicarbonate of Sodium. $NaHCO_3$; 84.—A white, opaque powder, permanent in the air; odorless; cooling, mildly saline taste; slight alkaline reaction. Made by washing commercial sodium bicarbonate with water.

SODII BICARBONAS VENALIS, U. S.—Commercial Bicarbonate of Sodium. (See Sodii Bicarbonas.)—Made by exposing sodium carbonate to the action of carbon dioxide.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\text{Sodium Bicarbonate.}}{2HNaCO_3}.$$

Sodium bicarbonate may also be prepared by Solvay's process. (See Sodium Carbonate.)

SODII BISULPHIS, U. S.—Bisulphite of Sodium. $NaHSO_3$; 104.—Opaque, prismatic crystals, or a crystalline or granular powder; slowly oxidized and losing sulphurous acid on exposure to air; faint, sulphurous odor; disagreeable, sulphurous taste; acid reaction. Made by saturating a solution of sodium carbonate with sulphurous acid.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Sulphurous Acid.}}{2H_2SO_3} = \underset{\text{Bisulphite of Sodium.}}{2NaHSO_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

SODII BORAS, U. S.—Borate of Sodium. $Na_2B_4O_7.10H_2O$; 385. (*Borax.*)—Colorless, transparent, shining, monoclinic prisms; slightly efflorescent in dry air; odorless; mild, cooling, sweetish, afterward somewhat alkaline, taste; alkaline reaction. Made by purifying the natural salts found in immense quantities in California, as a crystalline deposit in the blue mud of an offset of Clear Lake. It is sometimes, also, called biborate of sodium, and is found native in Thibet, Persia, etc. Another name given it is *Tincal*. Tuscany is also a source of borax, where it occurs, principally, as crude boric acid.

SODII BROMIDUM, U. S.—Bromide of Sodium. NaBr; 102.8.—Small, colorless, or white, monoclinic crystals, or a crystalline powder, permanent in dry air; odorless; saline, slightly bitter, taste; neutral or faintly-alkaline reaction. Made by treating ferrous bromide with sodium carbonate. The ferrous bromide is made by acting on iron wire with bromine, in the presence of water, and, after filtering, adding Na_2CO_3.

$$FeBr_2 + Na_2CO_3 = 2NaBr + FeCO_3.$$

SODII CARBONAS, U. S.—Carbonate of Sodium. $Na_2CO_3.10H_2O$; 286.—Large, colorless, monoclinic crystals; rapidly efflorescent in dry air, and falling into a white powder; odorless; sharp, alkaline taste; alkaline reaction.

Sodium Carbonate is made by three processes, as follows:—

LEBLANC'S PROCESS.—Common salt is converted into sodium carbonate, in this process, by two steps.

First Step.—Salt is converted into sodium sulphate by sulphuric acid.

$$\underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Hydrochloric Acid.}}{2HCl}.$$

Second Step.—The sodium sulphate, or *salt cake*, is decomposed by calcium carbonate and charcoal, at a high temperature, so as to yield sodium carbonate.

$$\underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Calcium Carbonate.}}{CaCO_3} + \underset{\text{Charcoal.}}{C_4} = \underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Calcium Sulphide.}}{CaS} + \underset{\text{Carbon Monoxide.}}{4CO}.$$

The sulphate, first dried, is mixed with its own weight of limestone and half its weight of coal, and fused into a black mass. Sodium sulphate is converted by the coal into sodium sulphide, which reacts with the limestone (calcium carbonate), so as to form calcium sulphide and sodium carbonate. The black mass is now digested in warm water, which takes up the alkali and leaves the insoluble impurities, called soda waste, which is afterward used in the manufacture of sodium hyposulphite. By evaporating to dryness, a mass is obtained, which is calcined with sawdust, which con-

verts the alkali—owing to the carbonic acid resulting from its combustion—fully into carbonate. Redissolving in water, and evaporating to dryness, gives the commercial salt. *Soda-ash* contains about 50 per cent. of sodium carbonate.

SOLVAY'S PROCESS.—This process, also, has two steps, and is known as the ammonia-soda process.

First Step.—Carbon dioxide is passed into a solution of common salt in ammonia water, which results in a double decomposition. Sodium bicarbonate is precipitated and ammonium chloride remains in solution.

$$\underset{\text{Sodium Chloride.}}{NaCl} + \underset{\text{Ammonia.}}{NH_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water}}{H_2O} = \underset{\text{Sodium Bicarbonate.}}{HNaCO_3} + \underset{\text{Ammonium Chloride.}}{NH_4Cl}.$$

Second Step.—Sodium bicarbonate is decomposed into sodium carbonate by heat.

$$\underset{\text{Sodium Bicarbonate.}}{4HNaCO_3} + \text{Heat} = \underset{\text{Sodium Carbonate.}}{2Na_2CO_3} + \underset{\text{Water.}}{2H_2O} + \underset{\text{Carbon Dioxide.}}{2CO_2}.$$

CRYOLITE PROCESS.—Largely used in the United States. This process has also two steps.

First Step.—Cryolite, which consists, mainly, of a double fluoride of aluminium and sodium ($Al_2F_6 + 6NaF$), is heated with chalk. Calcium fluoride is formed, while the sodium and aluminium combine to form sodium aluminate, which is dissolved out by lixiviation.

$$\underset{\text{Cryolite.}}{(Al_2F_6 + 6NaF)} + \underset{\text{Calcium Carbonate.}}{6CaCO_3} = \underset{\text{Sodium Aluminate.}}{Al_2O_3,3Na_2O} + \underset{\text{Calcium Fluoride.}}{6CaF_2} + \underset{\text{Carbon Dioxide.}}{6CO_2}.$$

Second Step.—The soda is converted into carbonate by passing carbon dioxide, under pressure, through the solution. The alumina separates from the soda, becomes insoluble, and is deposited.

$$\underset{\text{Sodium Aluminate.}}{(Al_2O_3 + 3Na_2O)} + \underset{\text{Carbon Dioxide.}}{3CO_2} = \underset{\text{Sodium Carbonate.}}{3Na_2CO_3} + \underset{\text{Alumina.}}{Al_2O_3}.$$

SODII CARBONAS EXSICCATUS, U. S.—Dried Carbonate of Sodium.—A white, hygroscopic powder, made by heating the carbonate.

SODII CHLORAS, U. S.—Chlorate of Sodium. $NaClO_3$; 106.4. —Colorless, transparent, tetrahedrons of the regular system, permanent in dry air; odorless, cooling, saline taste; neutral reaction. Made by double decomposition, between sodium bitartrate and potassium chlorate. (Wittstein's process.)

The details of the process are as follows:—

First, acid sodium tartrate is prepared by decomposing sodium carbonate with tartaric acid.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Tartaric Acid.}}{2H_2C_4H_4O_6} = \underset{\text{Acid Sodium Tartrate.}}{2NaHC_4H_4O_6} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

Then the acid sodium tartrate is added to the potassium chlorate:—

$$\underset{\text{Acid Sodium Tartrate.}}{NaHC_4H_4O_6} + \underset{\text{Potassium Chlorate.}}{KClO_3} = \underset{\text{Sodium Chlorate.}}{NaClO_3} + \underset{\text{Acid Potassium Tartrate.}}{KHC_4H_4O_6}.$$

SODII CHLORIDUM, U. S.—Chloride of Sodium. $NaCl$; 58.4. (*Common Salt.*)—White, shining, hard, cubical crystals or a crystalline powder, permanent in the air; odorless; purely saline taste; neutral reaction. Obtained by evaporating sea water, and the salt from salt wells, springs, etc.

SODII HYPOPHOSPHIS, U. S.—Hypophosphite of Sodium. $NaH_2PO_2.H_2O$; 106.—Small, colorless or white, rectangular plates, or a white, granular powder, deliquescent on exposure to the air; odorless; sweetish, saline taste; neutral reaction. Made by double decomposition between calcium hypophosphite and sodium carbonate.

$$\underset{\text{Calcium Hypophosphite.}}{Ca_2H_2PO_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Hypophosphite.}}{2NaH_2PO_2} + \underset{\text{Calcium Carbonate.}}{CaCO_3}.$$

Sometimes this salt explodes with violence during evaporation; this is supposed to be due to the employment of too much heat. Evaporation should, therefore, be performed below 100° C. (212° F.).

$$\underset{\text{Sodium Hypophosphite.}}{5NaH_2PO_2} = \underset{\text{Sodium Pyrophosphate.}}{Na_4P_2O_7} + \underset{\text{Sodium Metaphosphate.}}{NaPO_3} + \underset{\text{Phosphoretted Hydrogen.}}{2PH_3} + \underset{\text{Hydrogen.}}{2H_2}.$$

Hydrogen and phosphoretted hydrogen are evolved, the latter being spontaneously inflammable.

Hypophosphorous acid is the acid present in this salt.

SODII HYPOSULPHIS, U. S.—Hyposulphite of Sodium. $Na_2S_2O_3.5H_2O$; 248. (*Sodium Thiosulphate.*)—Large, colorless, transparent, monoclinic prisms or plates, efflorescent in dry air; odorless; cooling, somewhat bitter and sulphurous taste; neutral or faintly alkaline reaction. Made by decomposing calcium thiosulphate with sodium sulphate.

$$\underset{\text{Calcium Thiosulphate.}}{CaS_2O_3} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4} = \underset{\text{Sodium Thiosulphate.}}{Na_2S_2O_3} + \underset{\text{Calcium Sulphate.}}{CaSO_4}.$$

SODII IODIDUM, U. S.—Iodide of Sodium. NaI; 149.6.—Minute, colorless or white, monoclinic crystals, or a crystalline powder, deliquescent on exposure to air; odorless; saline, and slightly bitter taste; neutral or faintly alkaline reaction. Made by treating ferrous iodide with sodium carbonate.

$$\underset{\text{Ferrous Iodide.}}{FeI_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Iodide.}}{2NaI} + \underset{\text{Ferrous Carbonate.}}{FeCO_3}.$$

SODII NITRAS, U. S.—Nitrate of Sodium. $NaNO_3$; 85. *Cubic Nitre. Chili Saltpetre.*—Found in Chili and Peru.

Colorless, transparent, rhombohedral crystals, slightly deliquescent in damp air; odorless; cooling, saline and slightly bitter taste; neutral reaction. Made by purifying the native salt.

It is the cheapest source for obtaining nitrates.

SODII PHOSPHAS, U. S.—Phosphate of Sodium. $Na_2HPO_4.12H_2O$; 358.—Large, colorless, transparent, monoclinic prisms, speedily effloresecing and becoming opaque on exposure to air; odorless; cooling, saline and feebly alkaline taste; slightly alkaline reaction. Made by treating acid calcium phosphate with sodium carbonate. The details of the process are as follows:—

Acid calcium phosphate is made from bones, by treating them with sulphuric acid, after thorough calcination. To the concentrated liquid obtained from boiling this solution down, carbonate of sodium is added until the phosphoric acid is completely saturated. The liquid is then filtered and set aside to crystallize.

Details.—Bones consist of neutral calcium phosphate and animal matter. The latter is separated by burning them to whiteness, leaving a powder called bone phosphate or bone ash, associated with some calcium carbonate. When this is mixed with sulphuric acid, the calcium carbonate is decomposed, giving rise to effervescence. The calcium phosphate undergoes partial decomposition; the greater part of the lime being liberated, precipitates as calcium sulphate, while the phosphoric acid combines with the undecomposed portions of the phosphate, and remains in solution as an acid calcium phosphate, holding dissolved a small portion of calcium sulphate.

$$\underset{\substack{\text{Calcium}\\\text{Phosphate.}}}{Ca_3 2PO_4} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{2H_2SO_4} = \underset{\substack{\text{Acid Calcium}\\\text{Phosphate.}}}{CaH_4 2PO_4} + \underset{\substack{\text{Calcium}\\\text{Sulphate.}}}{2CaSO_4}$$

"In order to separate the acid phosphate from the precipitated mass of calcium sulphate, boiling water is added to the mixture. The whole is strained, and the sulphate washed as long as acid phosphate is removed, which is known by the water passing through in an acid state. The different liquids which have passed the strainer, consisting of the solution of acid calcium phosphate, are mixed and allowed to stand, and, by cooling, a portion of calcium sulphate is deposited, which is got rid of by decantation. The bulk of the liquid is now reduced by evaporation, and, in consequence of the diminution of water, a fresh portion of calcium sulphate is deposited, which is separated by a subsidence and decantation, as before. The acid calcium phosphate solution being heated, is now saturated by means of a hot solution of sodium carbonate, the carbonic acid is liberated with effervescence, and the alkali, combining with the excess of acid of the acid phosphate, produces sodium phosphate, while the acid calcium phosphate, by the loss of its excess of acid, becomes the neutral phosphate and precipitates.

$$\underset{\substack{\text{Acid Calcium}\\\text{Phosphate.}}}{CaH_4 2PO_4} + \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{Na_2CO_3} = \underset{\substack{\text{Calcium}\\\text{Phosphate.}}}{CaHPO_4} + \underset{\substack{\text{Sodium}\\\text{Phosphate.}}}{Na_2HPO_4} + \underset{\substack{\text{Water.}}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2}.$$

"The calcium phosphate is separated by filtration, and the filtered liquor, which is a solution of sodium phosphate, is evaporated, so as to crystallize." (Remington.)

SODII PYROPHOSPHAS, U. S.—Pyrophosphate of Sodium. $Na_4P_2O_7.10H_2O$; 446.—Colorless, translucent, monoclinic prisms; permanent in the air. Odorless; cooling, saline and feebly alkaline to the taste; slightly alkaline reaction. Made by heating sodium phosphate to redness, dissolving and crystallizing.

SODII SALICYLAS, U. S.—Salicylate of Sodium. $2NaC_7H_5O_3.H_2O$; 338.—Small, white, crystalline plates or a crystalline powder; permanent in the air. Odorless; sweetish, saline and mildly alkaline

taste; feebly acid reaction. Made by decomposing sodium carbonate with salicylic acid.

$$\underset{\text{Salicylic Acid.}}{2HC_7H_5O_3} + \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{Na_2CO_3} + \underset{\substack{\text{Sodium}\\\text{Salicylate.}}}{2NaC_7H_5O_3} + \underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2}.$$

SODII SANTONINAS, U. S. — Santoninate of Sodium. $2NaC_{15}H_{19}O_4.7H_2O$; 698.—Colorless, transparent, tabular, rhombic crystals, slowly colored yellow by exposure to light; slightly efflorescent in dry air; odorless; mildly saline and somewhat bitter taste; slightly alkaline reaction. Made by adding santonin to hot solution of sodium carbonate.

SODII SULPHAS, U. S. — Sulphate of Sodium. $Na_2SO_4.10H_2O$; 322. (*Glauber's Salt.*)—Large, colorless, transparent, monoclinic prisms, rapidly efflorescent on exposure to air, and ultimately falling into a white powder; insoluble in alcohol; odorless; cooling, saline and somewhat bitter taste; neutral reaction. Made by treating common salt with sulphuric acid.

SODII SULPHIS, U. S. — Sulphite of Sodium. $Na_2SO_3.7H_2O$; 252.—Colorless, transparent, monoclinic prisms; efflorescent in dry air; odorless; cooling, saline and sulphurous taste; neutral or feebly alkaline reaction. Made by decomposing sodium carbonate with sulphurous acid.

$$\underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{Na_2CO_3} + \underset{\substack{\text{Sulphurous}\\\text{Acid.}}}{SO_2} = \underset{\substack{\text{Sodium}\\\text{Sulphite.}}}{Na_2SO_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2}.$$

SODII SULPHOCARBOLAS, U. S.—Sulphocarbolate of Sodium. $NaC_6H_5SO_4.2H_2O$; 232.—Colorless, transparent, rhombic prisms; permanent in the air; odorless, or nearly so; cooling, saline, somewhat bitter taste; neutral reaction. Made by double decomposition between barium sulphocarbolate and sodium carbonate.

The details of the process are as follows: Carbolic acid and strong sulphuric acid are mixed together, which produces sulphocarbolic acid, $C_6H_5HSO_4$. After submitting the mixed liquids to a temperature of 55° C. (131° F.) for several days, the product is diluted in water. It is then mixed with barium carbonate gradually until effervescence ceases. Barium sulphate is precipitated also by any carbonate which may be present, and the liquor filtered. The solution of barium sulphocarbolate is now decomposed by a sodium carbonate. The liquid is filtered from barium carbonate and sodium sulphocarbolate obtained by evaporating and crystallizing.

$$\underset{\substack{\text{Carbolic}\\\text{Acid.}}}{C_6H_5HO} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\substack{\text{Sulphocarbolic}\\\text{Acid.}}}{HC_6H_5SO_4} + \underset{\text{Water.}}{H_2O}.$$

TROCHISCI SODII BICARBONATIS, U. S.—Troches of Bicarbonate of Sodium.—Each three grains. (See Trochisci, Part II.)

LITHIUM. Li; 7.

LITHII BENZOAS, U. S.—Benzoate of Lithium. $LiC_7H_5O_2$; 128.—A white powder, or small, shining scales; permanent in the air; odorless, or having a faintly benzoin-like odor; cooling and sweetish taste;

faintly acid reaction; made by treating lithium carbonate with benzoic acid.

$$\underset{\text{Lithium Carbonate.}}{Li_2CO_3} + \underset{\text{Benzoic Acid}}{2HC_7H_5O_2} = \underset{\text{Lithium Benzoate.}}{2LiC_7H_5O_2} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

LITHII BROMIDUM, U. S.—Bromide of Lithium. LiBr; 86.8.—A white, granular salt, very deliquescent; odorless; very sharp, somewhat bitter taste; neutral reaction. Made by decomposing ferrous bromide with lithium carbonate.

$$\underset{\text{Ferrous Bromide.}}{FeBr_2} + \underset{\text{Lithium Carbonate.}}{Li_2CO_3} = \underset{\text{Lithium Bromide.}}{2LiBr} + \underset{\text{Ferrous Carbonate.}}{FeCO_3}.$$

LITHII CARBONAS, U. S.—Carbonate of Lithium. Li_2CO_3; 74.—A light, white powder; permanent in the air; odorless; alkaline taste; alkaline reaction. Made by precipitating lithium sulphate with ammonium carbonate.

LITHII CITRAS, U. S.—Citrate of Lithium. $Li_3C_6H_5O_7$; 210.—A white powder; deliquescent on exposure to air; odorless; slightly cooling, faintly alkaline taste; neutral reaction. Made by decomposing the carbonate with citric acid.

$$\underset{\text{Lithium Carbonate.}}{3Li_2CO_3} + \underset{\text{Citric Acid.}}{2H_3C_6H_5O_7} = \underset{\text{Lithium Citrate.}}{2Li_3C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon Dioxide.}}{3CO_2}.$$

LITHII SALICYLAS, U. S.—Salicylate of Lithium. $2LiC_7H_5O_3.H_2O$; 306.—A white powder; deliquescent on exposure to air; odorless, or nearly so; sweetish taste; faintly alkaline reaction. Made by decomposing lithium carbonate with salicylic acid.

$$\underset{\text{Lithium Carbonate.}}{Li_2CO_3} + \underset{\text{Salicylic Acid.}}{2HC_7H_5O_3} = \underset{\text{Lithium Salicylate.}}{2LiC_7H_5O_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

AMMONIUM. NH_4.

AQUA AMMONIÆ, U. S.—Water of Ammonia.—A colorless, transparent liquid; very pungent odor; acrid, alkaline taste; strongly alkaline reaction, consisting of an aqueous solution of ammonia (NH_3), containing 10 per cent. by weight of the gas. Made by mixing ammonium chloride with milk of lime, and distilling over the gas into distilled water. The reaction is as follows:—

$$\underset{\text{Ammonium Chloride.}}{2NH_4Cl} + \underset{\text{Calcium Hydrate.}}{Ca_2HO} = \underset{\text{Ammonia.}}{2NH_3} + \underset{\text{Calcium Chloride.}}{CaCl_2} + \underset{\text{Water.}}{2H_2O}.$$

AQUA AMMONIÆ FORTIOR, U. S.—Stronger Water of Ammonia.—28 per cent. by weight aqueous soluti n NH_3. Specific gravity 0.900.

SPIRITUS AMMONIÆ, U. S.—Spirit of Ammonia.—An alcoholic solution of ammonia containing 10 per cent. by weight of the gas.

SPIRITUS AMMONIÆ AROMATICUS, U. S.—Aromatic Spirit of Ammonia.—An aromatic hydro-alcoholic solution of ammonium carbonate. (See Spiritus, Part II.)

LIQUOR AMMONII ACETATIS, U. S.—Solution of Acetate of Ammonium. (*Spirit of Mindererus*)—A clear, colorless liquid, free from empyreuma; mildly saline taste; neutral, or slightly acid reaction. Made by mixing solution of acetic acid and ammonium carbonate.

$$\underset{\text{Acid Ammonium Carbonate and Carbamate.}}{(NH_4HCO_3)NH_4NH_2CO_2} + \underset{\text{Acetic Acid.}}{3HC_2H_3O_2} =$$

$$\underset{\text{Ammonium Acetate.}}{3NH_4C_2H_3O_2} + \underset{\text{Carbon Dioxide.}}{2CO_2} + \underset{\text{Water.}}{H_2O}.$$

AMMONII BENZOAS, U. S.—Benzoate of Ammonium. $NH_4C_7H_5O_2$; 139.—Thin, white, four-sided, laminar crystals; permanent in the air; slight odor of benzoic acid; saline, bitter, afterward slightly acrid taste; neutral reaction. Made by dissolving benzoic acid in water of ammonia.

$$\underset{\text{Benzoic Acid.}}{HC_7H_5O_2} + \underset{\text{Water of Ammonia.}}{NH_4HO} = \underset{\text{Ammonium Benzoate.}}{NH_4C_7H_5O_2} + \underset{\text{Water.}}{H_2O}.$$

AMMONII BROMIDUM, U. S.—Bromide of Ammonium. NH_4Br; 97.8.—Colorless, transparent, prismatic crystals, or a white granular salt, becoming yellow on exposure to air; odorless, pungent, saline taste; neutral reaction. Made by adding water of ammonia, gradually, to bromine, under water. (Pile's Process.)

$$\underset{\text{Bromine.}}{6Br} + \underset{\text{Ammonia.}}{8NH_3} = \underset{\text{Ammonium Bromide.}}{6NH_4Br} + \underset{\text{Nitrogen.}}{N_2}$$

AMMONII CARBONAS, U. S.—Carbonate of Ammonium. $NH_4HCO_3.NH_4NH_2CO_2$, or $N_2H_{11}C_2O_5$; 157.—White, translucent masses, consisting of bicarbonate (acid carbonate) of ammonium and carbamate of ammonium, losing both ammonia and carbonic acid gas on exposure to air, becoming opaque and finally converted into friable, porous lumps or white powder (acid carbonate of ammonia); pungent, ammoniacal odor, free from empyreuma; sharp, saline taste; alkaline reaction. Made by subliming a mixture of ammonium chloride and calcium carbonate.

$$\underset{\text{Ammonium Chloride.}}{4NH_4Cl} + \underset{\text{Calcium Carbonate.}}{2CaCO_3} = \underset{\text{Ammonium Carbonate.}}{N_2H_{11}C_2O_5} + \underset{\text{Calcium Chloride.}}{2CaCl_2} + \underset{\text{Ammonia.}}{NH_3} + \underset{\text{Water.}}{H_2O}.$$

AMMONII CHLORIDUM, U. S.—Chloride of Ammonium. NH_4Cl; 53.4. (*Sal Ammoniac.*)—A snow-white, crystalline powder, permanent in the air; odorless; cooling, saline taste; slightly acid reaction. Made by subliming a mixture of ammonium sulphate and sodium chloride.

This salt is chiefly made from the gas liquor from gas works.

AMMONII IODIDUM, U. S.—Iodide of Ammonium. NH_4I; 144.6.—A white, granular salt, or minute, crystalline cubes; very deliquescent and soon becoming yellow or yellowish brown on exposure to air; odorless when white, but emitting a slight odor of iodine when colored; sharp, saline taste; neutral reaction. Made by mixing solutions of potassium iodide and ammonium sulphate.

$$\underset{\text{Potassium Iodide.}}{2KI} + \underset{\text{Ammonium Sulphate.}}{(NH_4)_2SO_4} = \underset{\text{Ammonium Iodide.}}{2NH_4I} + \underset{\text{Potassium Sulphate.}}{K_2SO_4}.$$

AMMONII NITRAS, U.S.—Nitrate of Ammonium. NH_4NO_3; 80.—Colorless crystals, generally in the form of long, thin, rhombic prisms, or fused masses; somewhat deliquescent; odorless; sharp, bitter taste; neutral reaction. Made by treating ammonium carbonate with nitric acid.

$$\underset{\text{Acid Ammonium Carbonate and Carbamate.}}{(NH_4HCO_3)NH_4NH_2CO_2} + \underset{\text{Nitric Acid.}}{3HNO_3} =$$

$$\underset{\text{Ammonium Nitrate.}}{3NH_4NO_3} + \underset{\text{Carbon Dioxide.}}{2CO_2} + \underset{\text{Water.}}{H_2O.}$$

AMMONII PHOSPHAS, U. S.—Phosphate of Ammonium. $(NH_4)_2HPO_4$; 132. — Colorless, translucent, monoclinic prisms, losing ammonia on exposure to dry air; odorless; cooling, saline taste; neutral or faintly alkaline reaction. Made by mixing solution of phosphoric acid and ammonia water.

$$\underset{\text{Ammonia Water.}}{2NH_4HO} + \underset{\text{Phosphoric Acid.}}{H_3PO_4} = \underset{\text{Ammonium Phosphate.}}{(NH_4)_2HPO_4} + \underset{\text{Water.}}{2H_2O.}$$

AMMONII SULPHAS, U. S. — Sulphate of Ammonium. $(NH_4)_2SO_4$; 132.—Colorless, transparent, rhombic prisms, permanent in the air; odorless; sharp, saline taste; neutral reaction. Made by saturating gas liquor with sulphuric acid, and crystallizing.

AMMONII VALERIANAS, U. S.—Valerianate of Ammonium. $NH_4C_5H_9O_2$; 119.—Colorless, or white, quadrangular plates, deliquescent in moist air; valerianic acid odor; sharp and sweetish taste; neutral reaction. Made by passing ammonia gas into monohydrated valerianic acid. The salt found in commerce is, usually, the acid salt, and should be neutralized with ammonia when used in solution for making preparations.

LINIMENTUM AMMONIÆ, U. S. — Ammonia Liniment. 30 p. AmHO, 70 p. Cotton seed Oil. (See Linimenta, Part II.)

TROCHISCI AMMONII, U. S.—Troches of Chloride of Ammonium. 2 grains each. (See Trochisci, Part II.)

MAGNESIUM, CALCIUM AND BARIUM.

BARIUM. Ba; 136.8.

There are no salts of barium officinal; some of its compounds, however, are used as tests.

MAGNESIUM. Mg; 24.

MAGNESIA, U. S.—Magnesia. MgO; 40. (*Light Magnesia.*)—A white, very light and fine powder, slowly absorbing carbonic acid from the air; odorless; an earthy, but no saline taste; faintly alkaline reaction when moistened with water. Made by calcining light magnesium carbonate.

$$\underset{\text{Magnesium Carbonate.}}{(MgCO_3)_4Mg(HO)_2} + \underset{\text{Water.}}{5H_2O} = \underset{\text{Magnesia.}}{5MgO} + \underset{\text{Carbon Dioxide.}}{4CO_2} + \underset{\text{Water.}}{6H_2O.}$$

MAGNESIA PONDEROSA, U. S.—Heavy Magnesia. MgO; 40.—A white, dense and very fine powder, corresponding, in all other

properties and reactions, with magnesia. Made by calcining heavy magnesium carbonate.

MAGNESII CARBONAS, U. S.—**Carbonate of Magnesium.** $(MgCO_3)_4.Mg(HO)_2.5H_2O$; 484. — Light, white, friable masses, or a light, white powder; odorless; tasteless; feebly alkaline reaction. Made by double decomposition between magnesium sulphate and sodium carbonate.

$$\underset{\text{Magnesium Sulphate.}}{5MgSO_4} + \underset{\text{Sodium Carbonate.}}{5Na_2CO_3} + \underset{\text{Water.}}{H_2O} =$$

$$\underset{\text{Magnesium Carbonate.}}{4MgCO_3,Mg(HO)_2} + \underset{\text{Sodium Sulphate.}}{5Na_2SO_4} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

The process for making light magnesium carbonate differs in nothing from the above, except that it is made with a cold dilute solution instead of a concentrated boiling solution, thus illustrating the general rule in precipitation, that dilute solutions produce light precipitates, and dense solutions heavy precipitates.

MAGNESII CITRAS GRANULATUS, U. S.—**Granulated Citrate of Magnesia.**—A white, coarsely granular salt, deliquescent on exposure to air; odorless; mildly acidulous, refreshing taste; acid reaction. Made from magnesium carbonate, citric acid, sodium bicarbonate, sugar, alcohol and distilled water. The carbonate of magnesia and part of the citric acid are rubbed together in the form of a thick paste, with distilled water, dried and powdered. The sugar, bicarbonate of sodium and the remainder of the citric acid, previously reduced to a fine powder, are then mixed with it. The mass is then dampened with alcohol and rubbed into a coarse, granular powder through a sieve.

MAGNESII SULPHAS, U. S. — **Sulphate of Magnesium.** $MgSO_4 7H_2O$; 246. (*Epsom Salt.*) — Small, colorless, right-rhombic prisms, or acicular needles, slowly efflorescent in dry air; odorless; cooling, saline and bitter taste; neutral reaction. Made by treating native magnesium hydrate with sulphuric acid.

Native magnesium hydrate is found in the United States, and is a silicious hydrate, practically free from lime. The mineral is treated with the acid, dried, and calcined, in order to convert into red oxide any ferrous sulphate which may be present. It is then dissolved in water, and calcium sulphide added to separate any remaining portion of iron. Purified by recrystallization.

Dolomite, the double carbonate of magnesium and calcium, is used in England for preparing Epsom salts. The carbon dioxide is driven off by heat, converting the residue into hydrates, which are treated with HCl. The calcium chloride formed by this reaction is dissolved out from the magnesium salt with water, and the latter converted into sulphate by treating it with sulphuric acid.

MAGNESII SULPHIS, U. S.—**Sulphite of Magnesium.** $MgSO_3 6H_2O$; 212.—A white, crystalline powder, gradually becoming oxidized on exposure to air; odorless; slightly bitter, somewhat sulphurous taste; neutral or slightly alkaline reaction. Made by treating magnesia in suspension with sulphurous acid gas.

LIQUOR MAGNESII CITRATIS, U. S.—Solution of Citrate of Magnesium.—Made by dissolving magnesia carbonate in citric acid, flavoring and adding potassium bicarbonate.

MISTURA MAGNESIÆ ET ASAFŒTIDÆ, U. S.—Mixture of Magnesia and Asafetida.—(Popularly known as Dewees' Carminative). Contains magnesia, tincture of asafetida and opium, sugar and water. (See Misturæ, Part II).

TROCHISCI MAGNESIÆ, U. S.—Troches of Magnesia.—Three grains each. (See Trochisci, Part II.)

CALCIUM. Ca; 40.

CALX, U. S.—Lime. CaO; 56.—Hard, white, or grayish-white, masses, gradually attracting moisture and carbonic acid gas on exposure to air, and falling to a white powder; odorless; sharp, caustic taste; alkaline reaction. Made by calcining chalk or limestone.

LIQUOR CALCIS, U. S.—Solution of Lime. (*Lime-water.*)—A clear, colorless liquid; specific gravity 1.0015 at 15° C. (59° F.); odorless; saline and feebly caustic taste; alkaline reaction. Made by dissolving lime in water. Contains about 0.15 per cent. of hydrate of calcium.

SYRUPUS CALCIS, U. S.—Syrup of Lime.—A saccharine solution of lime. (See Syrupi, Part II.)

LINIMENTUM CALCIS, U. S.—Lime Liniment.—Equal parts of lime-water and cotton-seed oil. Sometimes called Carron Oil. (See Linimenta, Part II.)

CALX CHLORATA, U. S.—Chlorinated Lime.—(See Chlorine, Part II.)

CALX SULPHURATA, U. S.—Sulphurated Lime.—A grayish-white, or yellowish-white powder, gradually altered by exposure to air, exhaling a faint odor of hydrosulphuric acid; offensive, alkaline taste; alkaline reaction. A mixture consisting chiefly of sulphide of calcium (CaS) and sulphate of calcium ($CaSO_4$), in varying proportions, but containing not less than 36 per cent. of absolute sulphide of calcium. Made by heating lime and sulphur to a low red heat.

CALCII BROMIDUM, U. S.—Bromide of Calcium. $CaBr_2$; 199.6.—A white, granular salt; very deliquescent; odorless; pungent, saline and bitter taste; neutral reaction. Made by dissolving lime in hydrobromic acid.

$$\underset{\text{Calcium Carbonate.}}{CaCO_3} + \underset{\text{Hydrobromic Acid.}}{2HBr} = \underset{\text{Calcium Bromide.}}{CaBr_2} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

CALCII CARBONAS PRÆCIPITATUS, U. S.—Precipitated Carbonate of Calcium. (*Precipitated Chalk.*) $CaCO_3$; 100—A very fine, white, impalpable powder, permanent in the air; odorless and tasteless. Made by double decomposition between calcium chloride and sodium carbonate.

$$\underset{\text{Calcium Chloride.}}{CaCl_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Calcium Carbonate.}}{CaCO_3} + \underset{\text{Sodium Chloride.}}{2NaCl}.$$

CRETA PRÆPARATA, U. S.—**Prepared Chalk.**—A white, amorphous powder, generally agglutinated in the form of small cones, permanent in the air; odorless and tasteless.

Prepared chalk is made from the native friable carbonate of calcium ($CaCO_3$), freed from most of its impurities by elutriation. (See Elutriation, Part I.)

CALCII CHLORIDUM, U. S.—**Chloride of Calcium.** $CaCl_2$; 110.8.—Colorless, slightly translucent, hard and friable masses, very deliquescent; odorless; hot, sharp, saline taste; neutral or faintly alkaline reaction. Made by acting on calcium carbonate with hydrochloric acid.

$$\underset{\text{Calcium Carbonate.}}{CaCO_3} + \underset{\text{Hydrochloric Acid.}}{2HCl} = \underset{\text{Calcium Chloride.}}{CaCl_2} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

CALCII HYPOPHOSPHIS, U. S.—**Hypophosphite of Calcium.** $CaH_4(PO_2)_2$; 170.—Colorless or white, six-sided prisms, or thin, flexible scales, of a pearly lustre, permanent in dry air; odorless; nauseous, bitter taste; neutral reaction. Made by heating phosphorus with milk of lime.

$$\underset{\text{Phosphorus.}}{8P} + \underset{\text{Calcium Hydrate.}}{3CaH_2O_2} + \underset{\text{Water.}}{6H_2O} = \underset{\text{Calcium Hypophosphite.}}{3CaH_4(PO_2)_2} + \underset{\text{Phosphoretted Hydrogen.}}{2PH_3}.$$

It is necessary to provide for the safe escape of the phosphoretted hydrogen gas evolved in this reaction, by conducting it, by a hood, into a powerful draught. No higher heat than 85° C. (185° F.) should be used, for fear of explosion.

SYRUPUS HYPOPHOSPHITUM, U. S.—**Syrup of Hypophosphites.** (See Syrupi, Part II.)

SYRUPUS HYPOPHOSPHITUM CUM FERRO, U. S.—**Syrup of Hypophosphites with Iron.** (See Syrupi, Part II.)

CALCII PHOSPHAS PRÆCIPITATUS, U. S.—**Precipitated Phosphate of Calcium.** $Ca_3(PO_4)_2$; 310.—A light, white, amorphous powder, permanent in the air; odorless and tasteless. Made by treating bone ash with HCl, and precipitating it with ammonia.

SYRUPUS CALCII LACTOPHOSPHATIS, U. S.—**Syrup of Lactophosphate of Calcium.**—Saccharine solution of calcium lactophosphate. (See Syrupi, Part II.)

PULVIS CRETÆ COMPOSITUS, U. S.—**Compound Chalk Powder.**—Prepared chalk, 30 p.; powdered acacia, 20 p.; powdered sugar, 50 p. Used for making chalk mixture.

MISTURA CRETÆ, U. S.—**Chalk Mixture.**—Compound chalk powder, 20 p.; Water and cinnamon water, each 40 p.

TROCHISCI CRETÆ, U. S.—**Troches of Chalk.**—Each four grains. (See Trochisci, Part II.)

ZINC, ALUMINIUM, CERIUM AND CADMIUM.

ZINCUM, U. S.—ZINC. Zn.; 64.9.

Metallic zinc, in the form of thin sheets, or irregular, granulated pieces. Prepared by roasting calamine (impure carbonate) with charcoal, and collecting the zinc vapors in water. A bluish-white metal.

ZINCI ACETAS, U. S.—Acetate of Zinc. $Zn(C_2H_3O_2)_2.3H_2O$; 236.9.—Soft, white, micaceous or pearly, six-sided tablets or scales, somewhat efflorescent in dry air; faintly acetous odor; sharp, metallic taste; slightly acid reaction. Made by heating zinc oxide with acetic acid.

$$\underset{\text{Zinc Oxide.}}{ZnO} + \underset{\text{Acetic Acid.}}{2HC_2H_3O_2} = \underset{\text{Zinc Acetate.}}{Zn(C_2H_3O_2)_2} + \underset{\text{Water.}}{H_2O}.$$

ZINCI BROMIDUM, U. S.—Bromide of Zinc. $ZnBr_2$; 224.5.—A white, or nearly white, granular powder, very deliquescent; odorless; sharp, saline and metallic taste; neutral reaction. Made by double decomposition of zinc sulphate and potassium bromide.

$$\underset{\substack{\text{Zinc}\\\text{Sulphate.}}}{ZnSO_4} + \underset{\substack{\text{Potassium}\\\text{Bromide.}}}{2KBr} = \underset{\substack{\text{Zinc}\\\text{Bromide.}}}{ZnBr_2} + \underset{\substack{\text{Potassium}\\\text{Sulphate.}}}{K_2SO_4}.$$

ZINCI CARBONAS PRÆCIPITATUS, U. S. Precipitated Carbonate of Zinc. $(ZnCO_3)_2.3Zn(HO)_2$; 546.5—A white, impalpable powder, permanent in the air; odorless and tasteless. Made by double decomposition of zinc sulphate and sodium carbonate.

$$\underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{5Na_2CO_3} + \underset{\substack{\text{Zinc}\\\text{Sulphate.}}}{5ZnSO_4} + \underset{\text{Water.}}{3H_2O} =$$

$$\underset{\text{Zinc Carbonate.}}{(ZnCO_3)_23Zn(HO)_2} + \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{5Na_2SO_4} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{3CO_2}.$$

Conduct at boiling heat, to prevent loss by the action of the CO_2 on the neutral carbonate, which occurs if cold solutions are used.

ZINCI CHLORIDUM, U. S.—Chloride of Zinc. $ZnCl_2$; 135.7.—A white crystalline powder, or white, opaque pieces, very deliquescent; odorless; very caustic, saline and metallic taste; acid reaction. Made by evaporating the officinal solution of chloride of zinc.

LIQUOR ZINCI CHLORIDI, U. S.—Solution of Chloride of Zinc. (*Burnett's Disinfecting Fluid*).—An aqueous solution of $ZnCl_2$ containing about 50 per cent. of the salt. Made by heating zinc with hydrochloric acid.

$$\underset{\text{Zinc.}}{2Zn} + \underset{\substack{\text{Hydrochloric}\\\text{Acid.}}}{4HCl} = \underset{\substack{\text{Zinc}\\\text{Chloride.}}}{2ZnCl_2} + \underset{\text{Hydrogen.}}{4H}.$$

ZINCI IODIDUM, U. S.—Iodide of Zinc. ZnI_2; 318.1.—A white, or nearly white, granular powder, very deliquescent; odorless; sharp, saline and metallic taste; acid reaction. Made by digesting zinc with iodine diffused in water.

ZINCI OXIDUM, U. S.—Oxide of Zinc. ZnO; 80.9.—A soft, pale yellowish, nearly white powder, permanent in the air; odorless and tasteless. Made by calcining zinc carbonate.

On the large scale, this salt is made by heating calamine and coal together, and separating the impurities by blowing the mixed vapors up a large tower, allowing the heavier particles to subside, and then by a powerful draught blowing outside into a room containing muslin bags, where it is deposited.

UNGUENTUM ZINCI OXIDI, U. S.—Oxide of Zinc Ointment. (See Unguenta, Part II.)

ZINCI PHOSPHIDUM, U. S.—Phosphide of Zinc. Zn_3P_2; 256.7.—Minutely crystalline, friable fragments, having a metallic lustre on the fractured surfaces, or a grayish-black powder; permanent in the air; faint odor and taste of phosphorus. Made by passing vapors of phosphorus over fused zinc in a current of dry hydrogen.

ZINCI SULPHAS, U. S.—Sulphate of Zinc. (*White Vitriol.*) $ZnSO_4.7H_2O$; 286.9.—Small, colorless, right rhombic prisms, or acicular needles, slowly efflorescing in dry air; odorless; sharp, saline, nauseous and metallic taste; acid reaction. Made by acting on zinc with diluted sulphuric acid.

$$\underset{\text{Zinc.}}{2Zn} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{2H_2SO_4} + \underset{\text{Water.}}{H_2O} = \underset{\substack{\text{Zinc}\\\text{Sulphate.}}}{2ZnSO_4} + \underset{\text{Hydrogen.}}{4H} + \underset{\text{Water.}}{H_2O}.$$

ZINCI VALERIANAS, U. S.—Valerianate of Zinc. $Zn(C_5H_9O_2)_2.H_2O$; 284.9.—Soft, white, pearly scales, permanent in the air; faint odor of valerianic acid; sweet, afterward styptic and metallic taste; acid reaction. Made by double decomposition of zinc sulphate and sodium valerianate.

$$\underset{\substack{\text{Sodium}\\\text{Valerianate.}}}{2NaC_5H_9O_2} + \underset{\substack{\text{Zinc}\\\text{Sulphate.}}}{ZnSO_4} = \underset{\substack{\text{Zinc}\\\text{Valerianate.}}}{Zn(C_5H_9O_2)_2} + \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{Na_2SO_4}$$

ALUMINIUM. Al; 27.

ALUMEN, U. S.—Alum. (*Aluminii et Potassii Sulphas. Pharm. 1870. Potassa-Alum.*) $K_2Al_2(SO_4)_4.24H_2O$; 948.—Large, colorless, octahedral crystals, sometimes modified by cubes, acquiring a whitish coating on exposure to air; odorless; sweetish, astringent taste; acid reaction. Made by treating alum clay with sulphuric acid and potassium sulphate.

ALUMEN EXSICCATUM, U. S.—Dried Alum. $K_2Al_2(SO_4)_4$; 516.—A white, granular powder, attracting moisture when exposed to the air; odorless; sweetish, astringent taste. Prepared by driving off the water of crystallization from alum.

ALUMINII HYDRAS, U. S.—Hydrate of Aluminium. $Al_2(HO)_6$; 156. (*Hydrated Alumina.*)—A white, light, amorphous powder, permanent in dry air; odorless and tasteless. Made by double decomposition of alum and sodium carbonate.

$$\underset{\text{Potassa-Alum.}}{K_2Al_2(SO_4)_4} + \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{3Na_2CO_3} + \underset{\text{Water.}}{3H_2O} =$$

$$\underset{\substack{\text{Aluminium}\\\text{Hydrate.}}}{Al_2(HO)_6} + \underset{\substack{\text{Potassium}\\\text{Sulphate.}}}{K_2SO_4} + \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{3Na_2SO_4} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{3CO_2}.$$

ALUMINII SULPHAS, U. S. — **Sulphate of Aluminium.** $Al_2(SO_4)_3.18H_2O$; 666. - A white, crystalline powder, permanent in the air; odorless; sweetish, and afterward astringent taste; acid reaction. Made by treating aluminium hydrate with sulphuric acid, and crystallizing.

CERIUM. Ce; 141.

CERII OXALAS, U. S. — **Oxalate of Cerium.** $Ce_2(C_2O_4)_3.9H_2O$; 708.—A white, slightly granular powder, permanent in the air; odorless and tasteless. Made by precipitating cerium chloride with oxalic acid.

The details of the process are as follows:—

A powdered mineral, containing the metal and silicates, is decomposed with H_2SO_4. The mass is then heated, and subsequently treated with HNO_3 and H_2S, to separate contaminating metals. Cerium chloride is now made by adding HCl, and this is precipitated by oxalic acid. This oxalate is then purified from lanthanum and didymium compounds by heating it with magnesium carbonate, to decompose the oxalates. The residue is now dissolved in HNO_3, and the solution added to water containing a little H_2SO_4. Ceric sulphate is produced, which is dissolved in H_2SO_4, and sodium sulphite added to reduce it to cerous sulphate. This is collected and treated with oxalic acid, when cerium oxalate precipitates.

The presence of the two rare metals, didymium and lanthanum, greatly complicate the preparation of this salt, as they can only be separated with difficulty.

CADMIUM. Cd; 111.8.

Cadmium enters into no officinal preparations, though it is used to some extent in medicine.

MANGANESE, IRON AND CHROMIUM.

MANGANESE. Mn; 54.

MANGANI OXIDUM NIGRUM, U. S.—**Black Oxide of Manganese.** (*Dioxide of Manganese.*)—A heavy, grayish-black, more or less gritty powder, permanent in the air; odorless and tasteless; consisting of native crude binoxide of manganese, containing at least 66 per cent. of the pure oxide (MnO_2; 86).

MANGANI SULPHAS, U. S. — **Sulphate of Manganese.** $MnSO_4.4H_2O$; 222.—Colorless, or pale rose-colored, transparent, right-rhombic prisms; odorless; slightly bitter and astringent taste; faintly acid reaction. Made by Prof. Diehl's process. Manganese dioxide and charcoal are heated together to redness, the residue treated with sulphuric acid and again heated to redness, and the residue dissolved in water. The solution is then filtered and crystallized.

POTASSII PERMANGANAS, U. S.—**Permanganate of Potassium.** (See Potassium.)

FERRUM, U. S.—IRON. Fe; 55.9.

Metallic iron, in the form of fine, bright and non-elastic wire.

FERRUM REDUCTUM, U. S.—Reduced Iron. Fe; 55.9.—A very fine, grayish-black, lustreless powder, permanent in dry air; without odor or taste. Made by passing hydrogen over subcarbonate of iron, heated in a reduction tube.

The subcarbonate directed in the U. S. P. process, is more properly an oxyhydrate, and the H combines with the O to form water, and metallic iron in fine powder is left behind.

$$\underset{\text{Ferric Oxide.}}{Fe_2O_3} + \underset{\text{Hydrogen.}}{6H} = \underset{\text{Iron.}}{2Fe} + \underset{\text{Water.}}{3H_2O}.$$

FERRI CARBONAS SACCHARATUS, U. S.—Saccharated Carbonate of Iron. (*Saccharated Ferrous Carbonate.*)—A greenish-gray powder, gradually oxidized by contact with air; odorless; at first a sweetish, afterward a slightly ferruginous taste; neutral reaction. Made by double decomposition between ferrous sulphate and sodium bicarbonate. The precipitate is preserved with sugar.

$$\underset{\text{Sulphate.}}{FeSO_4} + \underset{\text{Bicarbonate.}}{2NaHCO_3} = \underset{\text{Sulphate.}}{Na_2SO_4} + \underset{\text{Carbonate.}}{FeCO_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Dioxide.}}{CO_2}.$$

MASSA FERRI CARBONATIS, U. S.—Mass of Carbonate of Iron.—(*Pilula Ferri Carbonatis. Pharm., 1870.*)—Prepared by double decomposition between ferrous sulphate and sodium carbonate. The precipitate is preserved with honey, which prevents the ferrous carbonate from oxidizing.

$$\underset{\text{Sulphate.}}{FeSO_4} + \underset{\text{Carbonate.}}{Na_2CO_3} = \underset{\text{Carbonate.}}{FeCO_3} + \underset{\text{Sulphate.}}{Na_2SO_4}.$$

This preparation is called Vallet's Mass. (See Massæ, Part II.)

MISTURA FERRI COMPOSITA, U. S.—Compound Iron Mixture. (See Misturæ, Part II.)

PILULÆ FERRI COMPOSITÆ, U. S.—Compound Pills of Iron. (See Pilulæ, Part II.)

FERRI CHLORIDUM, U. S.—Chloride of Iron. $Fe_2Cl_6.12H_2O$; 540.2.—(*Ferric Chloride.*)—Orange-yellow, crystalline pieces, very deliquescent; odorless, or having a faint odor of hydrochloric acid; strongly styptic taste; acid reaction. Made by acting on iron with hydrochloric acid, which converts it into ferrous chloride $(FeCl_2)_2$, which is converted into ferric chloride (Fe_2Cl_6) by the addition of nitric and hydrochloric acids. The reaction is as follows:—

First Reaction.—

$$\underset{\text{Iron.}}{Fe_2} + \underset{\text{Hydrochloric Acid.}}{4HCl} = \underset{\text{Ferrous Chloride.}}{(FeCl_2)_2} + \underset{\text{Hydrogen.}}{4H}.$$

Second Reaction.—Conversion of ferrous chloride into ferric chloride.

$$\underset{\text{Ferrous Chloride.}}{6FeCl_2} + \underset{\text{Hydrochloric Acid.}}{6HCl} + \underset{\text{Nitric Acid.}}{2HNO_3} = \underset{\text{Ferric Chloride.}}{3Fe_2Cl_6} + \underset{\text{Nitrogen Dioxide.}}{N_2O_2} + \underset{\text{Water.}}{4H_2O}$$

LIQUOR FERRI CHLORIDI, U. S.—Solution of Chloride of Iron. (*Solution of Ferric Chloride.*)—A reddish-brown liquid, consisting of an aqueous solution (with some free hydrochloric acid) of ferric chloride (Fe_2Cl_6) containing 37.1% per cent. of the anhydrous salt. It has a faint odor of hydrochloric acid; acid, strongly styptic taste; acid reaction. Prepared by oxidizing solution of ferric chloride with nitric acid.

TINCTURA FERRI CHLORIDI, U. S.—Tincture of Chloride of Iron.—(See Tincturæ, Part II.)

FERRI CITRAS, U. S.—Citrate of Iron. $Fe_2(C_6H_5O_7)_2 \cdot 6H_2O$; 597.8.—Transparent, garnet-red scales, permanent in the air; odorless; very faint, ferruginous taste; acid reaction. Prepared by evaporating and scaling solution of ferric citrate.

FERRI ET AMMONII CITRAS, U. S.—Citrate of Iron and Ammonium. (*Ammonio-Ferric Citrate.*)—Transparent, garnet-red scales, deliquescent on exposure to damp air; odorless; saline, mildly ferruginous taste; neutral reaction. Prepared by adding water of ammonia to solution of ferric citrate, evaporating and scaling.

LIQUOR FERRI CITRATIS, U.S.—Solution of Citrate of Iron. (*Solution of Ferric Citrate.*)—A dark-brown liquid; odorless; having a slightly ferruginous taste and an acid reaction; sp. gr. 1.260; consisting of an aqueous solution of ferric citrate ($Fe_2(C_6H_5O_7)_2$) containing 35.5 per cent. of the anhydrous salt. Prepared by dissolving ferric hydrate in citric acid.

The ferric hydrate is prepared by precipitating solution of tersulphate of iron with water of ammonia.

$$\underset{\text{Ferric Sulphate.}}{Fe_2 3SO_4} + \underset{\text{Hydrate Ammonium.}}{6NH_4HO} = \underset{\text{Ferric Hydrate.}}{Fe_2(HO)_6} + \underset{\text{Ammonium Sulphate.}}{3(NH_4)_2SO_4}.$$

VINUM FERRI CITRATIS, U. S.—Wine of Citrate of Iron.—Generally known as Wine of Iron. (See Vina, Part II.)

FERRI ET QUININÆ CITRAS, U. S.—Citrate of Iron and Quinine.—Transparent, thin scales, varying in color from reddish-brown to yellowish-brown, slowly deliquescent on exposure to air; odorless; bitter and mildly ferruginous taste; slightly acid reaction. Made by dissolving quinine (alkaloid) in solution of ferric citrate, evaporating and scaling.

LIQUOR FERRI ET QUININÆ CITRATIS, U. S.—Solution of Citrate of Iron and Quinine.—A dark, greenish-yellow to yellowish-brown liquid, transparent in thin layers; odorless; bitter and mildly ferruginous taste; slightly acid reaction. Made by adding to a solution of citrate of iron and ammonium citric acid and quinine.

VINUM FERRI AMARUM, U. S.—Bitter Wine of Iron.—(See Vina, Part II.)

FERRI ET STRYCHNINÆ CITRAS, U. S.—Citrate of Iron and Strychnine.—Transparent, garnet-red scales, deliquescent on exposure to air; odorless; bitter and slightly ferruginous taste; slightly acid reaction. Made by adding to a solution of citrate of iron and ammonium, citric acid and strychnine, and scaling.

SYRUPUS FERRI QUININÆ ET STRYCHNINÆ PHOSPHATUM, U. S.—Syrup of the Phosphates of Iron, Quinine and Strychnine.—Made by dissolving in an acid solution of ferric phosphate,

quinine, strychnine and sugar. (See Syrupi, Part II.) This preparation is also sometimes known as *Easton's Syrup*.

FERRI ET AMMONII SULPHAS, U. S.—Sulphate of Iron and Ammonium. $Fe_2(NH_4)_2(SO_4)_4.24H_2O$; 963.8 (*Ammonio-Ferric Sulphate. Ammonio-Ferric Alum.*)—Pale-violet, octahedral crystals, efflorescent on exposure to air; odorless; acid, styptic taste; slightly acid reaction. Prepared by dissolving sulphate of ammonium in solution of ter-sulphate of iron, evaporating and crystallizing.

$$\underset{\text{Ferric Sulphate.}}{Fe_2 3SO_4} + \underset{\substack{\text{Ammonium}\\ \text{Sulphate.}}}{(NH_4)_2SO_4} = \underset{\text{Ammonio-Ferric Sulphate.}}{Fe_2(NH_4)_2(SO_4)_4}.$$

FERRI ET AMMONII TARTRAS, U. S.—Tartrate of Iron and Ammonium. (*Ammonio-Ferric Tartrate.*)—Transparent scales, varying in color from garnet-red to yellowish brown, only slightly deliquescent; odorless; sweetish and slightly ferruginous taste; neutral reaction. Prepared by dissolving ferric hydrate in solution of acid ammonium tartrate, and scaling.

FERRI ET POTASSI TARTRAS, U. S.—Tartrate of Iron and Potassium. (*Potassio-Ferric Tartrate.*)—Transparent, garnet-red scales, only slightly deliquescent; odorless; sweetish, slightly ferruginous taste; neutral reaction. Prepared by adding to ferric hydrate acid potassium tartrate and a trace of water of ammonia, and scaling.

FERRI HYPOPHOSPHIS, U. S.—Hypophosphite of Iron. $Fe_2(H_2PO_2)_6$; 501.8. (*Ferric Hypophosphite.*)—A white or grayish-white powder, permanent in the air; odorless; nearly tasteless. Made by double decomposition between calcium hypophosphite and ferrous sulphate. This is one of the hypophosphites recommended by Dr. Churchill in the treatment of phthisis.

$$\underset{\substack{\text{Calcium}\\ \text{Hypophosphite.}}}{Ca(H_2PO_2)_2} + \underset{\substack{\text{Ferrous}\\ \text{Sulphate.}}}{FeSO_4} = \underset{\substack{\text{Calcium}\\ \text{Sulphate.}}}{CaSO_4} + \underset{\substack{\text{Ferrous}\\ \text{Hypophosphite.}}}{Fe(H_2PO_2)_2}.$$

FERRI IODIDUM SACCHARATUM, U. S.—Saccharated Iodide of Iron. (*Saccharated Ferrous Iodide.*)—A yellowish-white or grayish powder, very hygroscopic; odorless; sweetish, ferruginous taste; slightly acid reaction. Made by adding solution of ferrous iodide to sugar of milk.

SYRUPUS FERRI IODIDI, U. S.—Syrup of Iodide of Iron.—Made by adding solution of ferrous iodide to sugar.

A syrupy liquid, containing 10 per cent. of FeI_2. (See Syrupi, Part II.)

SYRUPUS FERRI BROMIDI, U. S.—Syrup of Bromide of Iron.—Made by adding solution of ferric bromide to sugar. A syrupy liquid, containing ten per cent. of $FeBr_2$. (See Syrupi, Part II.)

PILULÆ FERRI IODIDI, U. S.—Pills of Iodide of Iron.—Reduced iron, 0.16 gr.; iodide, 0.8 gr.; glycyrrhiza, 0.5 gr.; sugar, 0.5 gr.; extract glycyrrhiza, 0.12 gr.; acacia, 0.12 gr.; water q. s. in each pill.

FERRI LACTAS, U. S.—Lactate of Iron. $Fe(C_3H_5O_3)_2.3H_2O$; 287.9. (*Ferrous Lactate.*)—Pale, greenish-white, crystalline crusts, or grains, permanent in air; odorless; mild, sweetish, ferruginous taste; slightly

acid reaction. Prepared by acting on iron with lactic acid, and crystallizing the solution.

$$\underset{\text{Iron.}}{Fe_2} + \underset{\text{Lactic Acid.}}{4HC_3H_5O_3} = \underset{\text{Ferrous Lactate.}}{2Fe(C_3H_5O_3)_2} + \underset{\text{Hydrogen.}}{H_4}.$$

FERRI OXALAS, U. S.—Oxalate of Iron. $FeC_2O_4.H_2O$; 161.9. (*Ferrous Oxalate.*)—A pale yellow, or lemon-yellow crystalline powder, permanent in the air; odorless and nearly tasteless. Prepared by mixing solutions of ferric sulphate and oxalic acid, and collecting the precipitate.

FERRI OXIDUM HYDRATUM, U. S.—Hydrated Oxide of Iron. $Fe_2(HO)_6$; 213.8. (*Ferric Hydrate.*)—Frequently used as an antidote for arsenic, and prepared by adding water of ammonia to solution of tersulphate of iron, collecting and washing the precipitate. The reaction is as follows:—

$$\underset{\substack{\text{Ferric}\\\text{Sulphate.}}}{Fe_23SO_4} + \underset{\substack{\text{Ammonium}\\\text{Hydrate.}}}{6NH_4HO} = \underset{\substack{\text{Ferric}\\\text{Hydrate.}}}{Fe_2(HO)_6} + \underset{\substack{\text{Ammonium}\\\text{Sulphate.}}}{3(NH_4)_2SO_4}.$$

The reaction occurs when it is used as an antidote, as follows:—

$$\underset{\substack{\text{Ferric}\\\text{Hydrate.}}}{2Fe_2(HO)_6} + \underset{\substack{\text{Arsenious}\\\text{Oxide.}}}{As_2O_3} = \underset{\substack{\text{Ferrous}\\\text{Arseniate.}}}{Fe_3(AsO_4)_2} + \underset{\substack{\text{Ferrous}\\\text{Hydrate.}}}{Fe(HO)_2} + \underset{\text{Water.}}{5H_2O}.$$

Hydrated oxide of iron should not be retained for any length of time on hand, because it decomposes even when kept under water. The ingredients, however, should always be ready for immediate use, weighed out in suitable bottles, and kept in an accessible and well-known place, ready for instant use in case of emergency.

FERRI OXIDUM HYDRATUM CUM MAGNESIA, U. S.—Hydrated Oxide of Iron with Magnesia.—Prepared by mixing solution of tersulphate of iron with magnesia mixture. (Magnesia mixed with water.)

This preparation is to be preferred to the above as an antidote for arsenic, as it is not necessary to wash the precipitate, and the reaction that occurs leaves in solution sulphate of magnesium, which acts as a cathartic, and carries off the ferrous arseniate formed.

The solutions for making hydrated oxide of iron with magnesia are prepared as follows: Take of solution of tersulphate of iron 1000 grains; mix it with twice its weight (or volume) of water, and keep the mixture in a well-stoppered bottle, marked No. 1. Rub 150 grains of magnesia with water to a smooth, thin mixture; transfer this to a bottle capable of holding one quart, and fill it up with water. Label this No. 2. When the preparation is wanted for use, mix the two liquids by adding the magnesia mixture (No. 2) gradually to the iron solution (No. 1), and shake them together until a homogeneous mass results. Give of this *ad libitum*.

TROCHISCI FERRI, U. S.—Troches of Iron.—Each contains five grains of dried ferric hydrate. (See Trochisci, Part II.)

EMPLASTRUM FERRI, U. S.—Plaster of Iron.—(See Emplastra, Part II.)

FERRI PHOSPHAS, U. S.—Phosphate of Iron. (*Ferric Phosphate.*)—Thin, bright green, transparent scales, permanent in dry air when excluded from light, but turning dark on exposure to light; odorless;

acidulous, slightly saline taste; slightly acid reaction. Prepared by mixing solutions of citrate of iron and phosphate of sodium, evaporating in scales.

This is not a definite chemical compound, but is sometimes termed sodio-ferric, citrate-phosphate, and greatly resembles the officinal ferric pyrophosphate. It is a scaled salt, and quite different from the insoluble slate-colored powder, of phosphate of iron, formerly officinal.

FERRI PYROPHOSPHAS, U. S.—Pyrophosphate of Iron. (*Ferric Pyrophosphate.*)—Thin, apple-green, transparent scales, permanent in dry air when excluded from light, but turning dark on exposure to light; odorless; acidulous, slightly saline taste; slightly acid reaction. Made by mixing solutions of citrate of iron and pyrophosphate of sodium, evaporating in scales.

The compound is a mixture of several salts, and not a definite chemical compound. It consists of sodio-ferric pyrophosphate, sodio-ferric citrate, and ferric sulphate. It differs from the salt formerly officinal, which was an insoluble ferric phosphate $Fe_4 3P_2O_7$, dissolved in solution of ammonia citrate. It also differs from that insoluble gelatinous precipitate sometimes formed when tincture of chloride of iron is added to dilute phosphoric acid. This is also a pyrophosphate of iron.

FERRI SULPHAS, U. S.—Sulphate of Iron. $FeSO_4 7H_2O$; 277.9. (*Ferrous Sulphate. Green Vitriol.*)—Large, pale, bluish-green, monoclinic prisms, efflorescent, and absorbing oxygen on exposure to air; odorless; saline, styptic taste; acid reaction. Made by treating iron with diluted sulphuric acid, evaporating and crystallizing.

$$\underset{\text{Iron.}}{Fe_2} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{2H_2SO_4} = \underset{\substack{\text{Ferrous}\\\text{Sulphate.}}}{2FeSO_4} + \underset{\text{Hydrogen.}}{4H.}$$

FERRI SULPHAS EXSICCATUS, U. S.—Dried Sulphate of Iron. $FeSO_4.H_2O$; 169.9. (*Dried Ferrous Sulphate.*)—A grayish-white powder, prepared by exsiccating ferrous sulphate at a temperature not above 149° C. (300° F.), and still containing about 15 per cent. water of crystallization.

FERRI SULPHAS PRÆCIPITATUS, U. S.—Precipitated Sulphate of Iron. $FeSO_4.7H_2O$; 277.9. (*Precipitated Ferrous Sulphate.*)—A very pale, bluish-green, crystalline powder, efflorescent in dry air, but when in contact with moisture, becoming gradually oxidized; odorless; saline, styptic taste; acid reaction. Made by precipitating an aqueous solution of ferrous sulphate with alcohol.

PILULÆ ALOES ET FERRI, U. S.—Pills of Aloes and Iron. —(See Pilulæ, Part II.)

FERRI VALERIANAS, U. S.—Valerianate of Iron. $Fe_2(C_5H_9O_2)_6$; 717.8. (*Ferric Valerianate.*)—A dark, tile-red, amorphous powder, permanent in dry air; faint odor of valerian; acid, mildly styptic taste. Prepared by double decomposition, between ferric sulphate and sodium valerianate.

LIQUOR FERRI ACETATIS, U. S.—Solution of Acetate of Iron.—A dark, red-brown, transparent liquid; acetous odor; sweetish, faintly styptic taste; slightly acid reaction. An aqueous solution of ferric acetate ($Fe_2(C_2H_3O_2)_6$) containing 33 per cent. of the anhydrous salt. Prepared by dissolving ferric hydrate in glacial acetic acid.

TINCTURA FERRI ACETATIS, U. S.—Tincture of Acetate of Iron. (*Tincture of Ferric Acetate.*)—(See Tincturæ, Part II.)

MISTURA FERRI ET AMMONII ACETATIS, U. S.—Mixture of Acetate of Iron and Ammonium.—(See Misturæ, Part II.) This preparation is also known as *Basham's Mixture.*

LIQUOR FERRI NITRATIS, U. S.—Solution of Nitrate of Iron. (*Solution of Ferric Nitrate.*)—A transparent, amber-colored, or reddish liquid, without odor, having an acid, strongly styptic taste, and an acid reaction; specific gravity 1.050. Made by dissolving ferric hydrate in dilute nitric acid.

LIQUOR FERRI SUBSULPHATIS, U. S.—Solution of Subsulphate of Iron.—(*Solution of Basic Ferric Sulphate. Monsell's Solution.*)—A dark, reddish-brown, almost syrupy liquid; specific gravity 1.555; odorless, or nearly so; extremely astringent taste, free from causticity; acid reaction. Made by heating ferrous sulphate in a mixture of sulphuric and nitric acid. An aqueous solution, containing 43.7 per cent. of $Fe_4O(SO_4)_5$.

LIQUOR FERRI TERSULPHATIS, U. S.—Solution of Tersulphate of Iron. (*Solution of Normal Ferric Sulphate.*)—A dark, reddish-brown liquid; almost odorless; acid, strongly styptic taste; acid reaction. Made by heating ferrous sulphate in a mixture of nitric acid with excess of sulphuric acid.

This solution differs from the solution of subsulphate of iron, merely in containing a larger proportion of sulphuric acid. It has the specific gravity of 1.320, and is a solution of the *true* persulphate $Fe_2(SO_4)_3$, or normal ferric sulphate. Solution of persulphate of iron is the name under which Monsell's Solution is erroneously prescribed. The latter is a solution of a subsalt, $Fe_4O(SO_4)_5$. The reaction is as follows:—

$$\underset{\text{Ferrous Sulphate.}}{6FeSO_4} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} + \underset{\text{Nitric Acid.}}{2HNO_3} = \underset{\text{Ferric Sulphate.}}{3(Fe_23SO_4)} + \underset{\text{Nitrogen Monoxide.}}{2NO} = \underset{\text{Water.}}{4H_2O.}$$

CHROMIUM. Cr; 52.4.

ACIDUM CHROMICUM, U. S.—Chromic Acid. CrO_3; 100.4.—Small, crimson, needle-shaped, or columnar crystals, deliquescent, having a caustic effect upon the skin and other animal tissues; odorless; acid reaction. Made by decomposing potassium bichromate with sulphuric acid. Chromic acid is more properly called *chromic anhydride.*

$$\underset{\text{Potassium Bichromate.}}{K_2Cr_2O_7} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} = \underset{\text{Chromic Acid.}}{2CrO_3} + \underset{\text{Potassium Acid Sulphate.}}{2KHSO_4} + \underset{\text{Water.}}{H_2O.}$$

NICKEL, COBALT AND TIN.

Ni; 58. Co; 58.9. Sn; 117.7.

There are no officinal preparations of these metals. Nickel has recently come into use in the form of bromide, chloride, etc., and seems to be of considerable merit. None of the unofficinal salts of cobalt are of pharmaceutical interest. Tin is of no interest pharmaceutically, but its salts are of great importance in the arts.

LEAD, COPPER, SILVER AND MERCURY.

LEAD. Pb (Plumbum); 206.5.

Lead is obtained by roasting the native sulphide, *Galena*. It is a heavy, soft, bluish metal, with a specific gravity of 11.45.

Lead and its compounds are poisonous; and as this metal is used to a large extent in the manufacture of water-pipes, the effect of water on lead is of interest. Pure water is a solvent of lead to a certain extent, owing to the formation of slightly soluble hydroxide or carbonate. The purer the water the more dangerous it is in this way. If traces of sulphates or chlorides be present in the water, however, an insoluble coating is formed on the surface of the metal, which protects it from further decomposition.

PLUMBI ACETAS, U. S.—Acetate of Lead. $Pb(C_2H_3O_2)_2.3H_2O$; 378.5. (*Sugar of Lead.*)—Colorless, shining, transparent, prismatic crystals or scales; efflorescent and attracting carbonic acid on exposure to air; faintly acetous odor; sweetish, astringent, afterward metallic taste; faintly acid reaction. Made by treating lead oxide with acetic acid, evaporating and crystallizing.

$$\underset{\text{Lead Oxide.}}{PbO} + \underset{\text{Acetic Acid.}}{2HC_2H_3O_2} = \underset{\text{Lead Acetate.}}{Pb(C_3H_3O_2)_2} + \underset{\text{Water.}}{H_2O.}$$

The commercial salt is unfit for use, because it usually contains carbonate and oxide of lead.

LIQUOR PLUMBI SUBACETATIS, U. S.—Solution of Subacetate of Lead. (*Goulard's Extract.*)—A clear, colorless liquid, of a sweetish, astringent taste and an alkaline reaction; sp. gr. 1.228. Made by boiling solution of lead acetate with lead oxide.

The subacetate is not a definite salt, but as found in officinal solutions, it is a mixture of oxyacetates, produced by boiling the normal acetate in water in contact with the oxide. The following reaction occurs:—

$$\underset{\text{Lead Oxide.}}{3PbO} + \underset{\text{Lead Acetate.}}{3(Pb2C_2H_3O_2)} =$$

$$\underset{\text{Lead Oxyacetates.}}{Pb_3O(C_2H_3O_2)_4 + Pb_3O_2(C_2H_3O_2)_2.}$$

LIQUOR PLUMBI SUBACETATIS DILUTUS, U. S.—Diluted Solution of Subacetate of Lead. (*Lead-Water.*)—Made by diluting 3 parts of solution of subacetate of lead with 97 parts of water.

The opalescence of lead-water is due to the formation of a trace of carbonate, if the distilled water used has not been recently freed from carbonic acid gas by boiling and cooling it. A few drops of acetic acid will clear it, however; but it should be dispensed opalescent, to distinguish it from lime-water, for which it has often been mistaken, with serious results.

CERATUM PLUMBI SUBACETATIS, U. S.—Cerate of Subacetate of Lead. (*Goulard's Cerate.*)—20 p. Goulard's Extract; 80 p. Camphor Cerate. (See Cerata, Part II.)

LINIMENTUM PLUMBI SUBACETATIS, U. S.—Liniment of Subacetate of Lead.—Goulard's Extract, 40 p.; Cottonseed Oil, 60 p. (See Linimenta, Part II.)

PLUMBI CARBONAS, U. S.—Carbonate of Lead.—$(PbCO_3)_2 \cdot Pb(HO)_2$; 773.5. (*White Lead.*)—A heavy, white, opaque powder or pulverulent mass, permanent in the air; odorless and tasteless. Made by acting on metallic lead with fumes of acetic acid and decaying matter.

Plumbi carbonas is a mixture of carbonate and hydrate.

UNGUENTUM PLUMBI CARBONATIS, U. S.—Ointment of Carbonate of Lead.—Lead Carbonate, 10 p.; Benzoated Lard, 90 p. (See Unguenta, Part II.)

PLUMBI IODIDUM, U. S.—Iodide of Lead. PbI_2; 459.7.—A heavy, bright, citron-yellow powder, permanent in the air; odorless; tasteless; neutral reaction. Made by double decomposition between lead nitrate and potassium iodide.

$$\underset{\text{Potassium Iodide.}}{2KI} + \underset{\text{Lead Nitrate.}}{Pb2NO_3} = \underset{\text{Lead Iodide.}}{PbI_2} + \underset{\text{Potassium Nitrate.}}{2KNO_3}.$$

UNGUENTUM PLUMBI IODIDI. U. S.—Ointment of Iodide of Lead.—Lead Iodide, 10 p.; Benzoated Lard, 90 p. (See Unguenta, Part II.)

PLUMBI NITRAS, U. S.—Nitrate of Lead. $Pb_2(NO_3)_2$; 330.5—Colorless, transparent, or white, nearly opaque, octahedral crystals, permanent in the air; odorless; sweetish, astringent, afterward metallic taste; acid reaction. Made by treating lead oxide with diluted nitric acid, evaporating and crystallizing.

PLUMBI OXIDUM, U. S.—Oxide of Lead. PbO; 222.5. (*Litharge.*)—A heavy, yellowish or reddish-yellow powder, or minute scales, permanent in the air; odorless; tasteless. Made by roasting lead ore.

Red Lead is a higher oxide, Pb_3O_4. Made by sprinkling hot litharge (PbO) with water, powdering, drying and heating out of contact with air.

EMPLASTRUM PLUMBI, U. S.—Lead Plaster.—Made by boiling lead with olive oil and water. The lead combines with the fatty acids of the oil and forms an oleo-palmitate of lead, setting free glyceryl, which unites with the water present to form hydrate of glyceryl, or glycerin. (See Emplastra, Part II.)

UNGUENTUM DIACHYLON, U. S.—Diachylon Ointment.—Made by diluting lead plaster with olive oil and perfuming with oil of lavender. (See Unguenta, Part II.)

COPPER. Cu; 63.2.

CUPRI ACETAS, U. S.—Acetate of Copper. $Cu(C_2H_3O_2)_2 \cdot H_2O$; 199.2.—Dark-green, prismatic crystals, yielding a bright green powder, efflorescent on exposure to air; odorless; nauseating, metallic taste; acid reaction. Made by treating copper with acetic acid, and crystallizing. It is a cupric salt, and is commonly called *verdigris*.

CUPRI SULPHAS, U. S.—Sulphate of Copper. $CuSO_4.5H_2O$; 249.2—Large, transparent, deep blue, triclinic crystals; efflorescent; odorless; nauseous, metallic taste; acid reaction. Commonly called *blue vitriol*.

SILVER. Ag; 107.7.

A brilliant, white metal, very malleable and ductile, having a specific gravity of 10.4 to 10.5.

ARGENTI CYANIDUM, U. S.—Cyanide of Silver. AgCN; 133.7.—A white powder, permanent in dry air, but gradually turning brown by exposure to light; odorless and tasteless. Made by passing hydrocyanic gas into solution of silver nitrate, or by mixing solutions of silver nitrate with potassium cyanide.

$$\underset{\text{Silver Nitrate.}}{AgNO_3} + \underset{\text{Potassium Cyanide.}}{KCN} = \underset{\text{Silver Cyanide.}}{AgCN} + \underset{\text{Potassium Nitrate.}}{KNO_3}.$$

ARGENTI IODIDUM, U. S.—Iodide of Silver. AgI; 234.3.—A heavy, amorphous, light-yellowish powder, unaltered by light if pure, but generally becoming somewhat greenish-yellow; odorless and tasteless. Made by double decomposition between potassium iodide and silver nitrate.

$$\underset{\text{Potassium Iodide.}}{KI} + \underset{\text{Silver Nitrate.}}{AgNO_3} = \underset{\text{Silver Iodide.}}{AgI} + \underset{\text{Potassium Nitrate.}}{KNO_3}.$$

ARGENTI NITRAS, U. S.—Nitrate of Silver. $AgNO_3$; 169.7.—Colorless, transparent, tabular, rhombic crystals, becoming gray or grayish-black on exposure to light in the presence of organic matter; odorless; bitter, caustic, and strongly metallic taste; neutral reaction. Made by treating metallic silver with nitric acid, evaporating and crystallizing.

$$\underset{\text{Silver.}}{Ag_3} + \underset{\text{Nitric Acid.}}{4HNO_3} = \underset{\text{Silver Nitrate.}}{3AgNO_3} + \underset{\text{Nitrogen Monoxide.}}{NO} + \underset{\text{Water.}}{2H_2O}.$$

ARGENTI NITRAS DILUTUS, U. S.—Diluted Nitrate of Silver.—Equal parts of nitrate of silver and nitrate of potassium, melted and moulded.

ARGENTI NITRAS FUSUS, U. S.—Moulded Nitrate of Silver.—Made by fusing and moulding silver nitrate in the form of points or cones.

A white, hard solid, generally in the form of pencils or cones, of a fibrous fracture, becoming gray or grayish-black on exposure to light in presence of organic matter; odorless; bitter, caustic, and strongly metallic taste; neutral reaction. The officinal process calls for a small portion of HCl, which is added to give greater toughness to the pencils.

ARGENTI OXIDUM, U. S.—Oxide of Silver.—Ag_2O; 231.4.—A heavy, dark, brownish-black powder, liable to reduction by exposure to light; odorless; metallic taste; imparting alkaline reaction to water. Made by precipitating solution of silver nitrate with solution of potassium hydrate.

$$\underset{\text{Silver Nitrate.}}{2AgNO_3} + \underset{\text{Potassium Hydrate.}}{2KHO} = \underset{\text{Silver Oxide.}}{Ag_2O} + \underset{\text{Potassium Nitrate.}}{2KNO_3} + \underset{\text{Water.}}{H_2O}.$$

MERCURY. Hg; 199.7

HYDRARGYRUM, U. S.—Mercury. Hg; 199.7 (Quicksilver.)—A shining, silver-white metal, liquid at temperatures above—40° C. (—40° F.); odorless and tasteless.

Mercury may be purified from mechanical impurities by squeezing it through chamois, or by distillation with HCl, after which the HCl is washed out with distilled water, and the mercury dried by the aid of filtering paper and a water bath.

HYDRARGYRUM CUM CRETA, U. S.—Mercury with Chalk.—Made by extinguishing 38 p. Hg with 12 p. sugar of milk and 50 p. prepared chalk.

EMPLASTRUM HYDRARGYRI, U. S.—Mercurial Plaster.—Made by extinguishing 30 p. Hg, 10 p. melted resin and olive oil, and incorporating with 50 p. melted lead plaster. (See Emplastra, Part II.)

EMPLASTRUM AMMONIACI CUM HYDRARGYRO, U. S.—Ammoniac Plaster with Mercury.—Made by extinguishing 18 per cent. of Hg with ammonia, olive oil, sublimed sulphur, diluted acetic acid and lead plaster. (See Emplastra, Part II.)

MASSA HYDRARGYRO, U. S.—Mass of Mercury. (*Blue mass. Blue pill.*)—Made by extinguishing 33 p. Hg with honey of rose and glycerine, adding powdered glycyrrhiza and powdered althæa. (See Massæ, Part II.)

UNGUENTUM HYDRARGYRI, U. S.—Mercurial Ointment. Made by extinguishing 450 p. Hg with 40 p. tr. benzoin comp. and 100 p. of Hg ointment, then adding 225 p. each, melted lard and suet. (See Unguenta, Part II.)

HYDRARGYRUM AMMONIATUM, U. S.—Ammoniated Mercury. NH_2HgCl; 251.1. (*White Precipitate. Mercurammonium Chloride.*)—White, pulverulent pieces, or a white powder, permanent in the air; odorless and tasteless. Made by precipitating solution of mercuric chloride with water of ammonia.

$$\underset{\text{Mercuric Chloride.}}{HgCl_2} + \underset{\text{Water of Ammonia.}}{2NH_4HO} = \underset{\text{Ammonium Chloride.}}{NH_4Cl} + \underset{\text{Mercurammonium Chloride.}}{NH_2HgCl} + \underset{\text{Water.}}{2H_2O}.$$

UNGUENTUM HYDRARGYRI AMMONIATI, U. S.—Ointment of Ammoniated Mercury.—Ammoniated mercury, 10 p.; benzoated lard, 90 p.

HYDRARGYRI CHLORIDUM CORROSIVUM, U. S.—Corrosive Chloride of Mercury. $HgCl_2$; 270.5. (*Corrosive Sublimate. Mercuric Chloride.*)—Heavy, colorless, rhombic crystals, or crystalline masses, permanent in the air; odorless; acrid and persistent metallic taste; acid reaction. Made by subliming mercuric sulphate with sodium chloride.

The mercuric sulphate is formed by boiling Hg with H_2SO_4.

$$\underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sulphurous Acid.}}{SO_2} + \underset{\text{Water.}}{2H_2O}.$$

This is mixed with NaCl and sublimed. The following reaction occurs. Sodium sulphate remains behind.

$$\underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sodium Chloride.}}{(NaCl)_2} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Mercuric Chloride.}}{HgCl_2}.$$

HYDRARGYRI CHLORIDUM MITE, U. S.—Mild Chloride of Mercury. Hg_2Cl_2; 470.2. (*Calomel. Mercurous Chloride.*)—A

white, impalpable powder, permanent in the air; odorless and tasteless. Prepared by subliming mercuric sulphate and mercury with sodium chloride.

In preparing calomel, mercuric sulphate is formed in the same manner as in the preparation of corrosive sublimate; this is then triturated with a quantity of mercury equal to that used in forming it, thus producing mercurous sulphate, which is then sublimed with sodium chloride. Sodium sulphate remains behind.

$$\underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sulphurous Acid.}}{SO_2} + \underset{\text{Water.}}{2H_2O.}$$

$$\underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercurous Sulphate.}}{Hg_2SO_4.}$$

$$\underset{\text{Mercurous Sulphate.}}{Hg_2SO_4} + \underset{\text{Sodium Chloride.}}{2NaCl} = \underset{\text{Mercurous Chloride.}}{Hg_2Cl_2} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4.}$$

HYDRARGYRI CYANIDUM, U. S.—**Cyanide of Mercury.** $Hg(CN)_2$; 251.7. (*Mercuric Cyanide.*)—Colorless, or white, prismatic crystals, becoming colored on exposure to light; odorless; bitter, metallic taste; neutral reaction. Made by passing hydrocyanic acid into a vessel containing mercuric oxide, with water.

$$\underset{\text{Hydrocyanic Acid.}}{(HCN)_2} + \underset{\text{Mercuric Oxide.}}{HgO} = \underset{\text{Mercuric Cyanide.}}{Hg(CN)_2} + \underset{\text{Water.}}{H_2O.}$$

HYDRARGYRI IODIDUM RUBRUM, U. S.—**Red Iodide of Mercury.** HgI_2; 452.9. (*Biniodide of Mercury. Mercuric Iodide.*)—A scarlet-red, crystalline powder, permanent in the air; odorless and tasteless. Made by double decomposition between mercuric chloride and potassium iodide.

$$\underset{\text{Mercuric Chloride.}}{HgCl_2} + \underset{\text{Potassium Iodide.}}{2KI} = \underset{\text{Mercuric Iodide.}}{HgI_2} + \underset{\text{Potassium Chloride.}}{2KCl.}$$

HYDRARGYRI IODIDUM VIRIDE, U. S.—**Green Iodide of Mercury.** Hg_2I_2; 652.6. (*Protiodide of Mercury. Mercurous Iodide.*)—A dark-green to greenish-yellow powder, becoming more yellow by exposure to air and darker by exposure to light. Odorless and tasteless. Made by rubbing together mercury and iodine and adding alcohol. Alcohol is added to keep down the temperature by its evaporation, and as some HgI_2 is formed and is soluble in alcohol, it may be washed out thereby.

HYDRARGYRI OXIDUM FLAVUM, U. S.—**Yellow Oxide of Mercury.** HgO; 215.7. (*Yellow Mercuric Oxide.*)—A light, orange-yellow, heavy, impalpable powder, permanent in the air and turning darker on exposure to light.

$$\underset{\text{Mercuric Chloride.}}{HgCl_2} + \underset{\text{Potassium Hydrate.}}{2KHO} = \underset{\text{Mercuric Oxide.}}{HgO} + \underset{\text{Potassium Chloride.}}{2KCl} + \underset{\text{Water.}}{H_2O.}$$

This oxide, when digested on a water-bath for fifteen minutes, with a strong solution of oxalic acid, forms mercuric oxalate of a white color, distinguishing it from red oxide.

UNGUENTUM HYDRARGYRI OXIDI FLAVI, U. S.—**Ointment of Yellow Oxide of Mercury.**—Oxide, 10 p.; ointment, 90 p.

OLEATUM HYDRARGYRI, U. S.—Oleate of Mercury.—Made by dissolving 10 p. dried yellow oxide in 90 p. oleic acid, without heat.

HYDRARGYRI OXIDUM RUBRUM. U. S.—Red oxide of Mercury. HgO; 215.7. (*Red Precipitate. Red Mercuric Oxide.*)—Heavy, orange-red, crystalline scales, or a crystalline powder, becoming more yellow the finer it is divided, permanent in the air; odorless and tasteless. Made by decomposing mercuric nitrate by heat.

$$\underset{\text{Mercuric Nitrate.}}{(Hg2NO_3)_2} = \underset{\text{Mercuric Oxide.}}{(HgO)_2} + \underset{\text{Nitrogen Dioxide.}}{4NO_2} + \underset{\text{Oxygen.}}{O_2}.$$

UNGUENTUM HYDRARGYRI OXIDI RUBRI, U. S.—Ointment of Red Oxide of Mercury.—Red oxide, 10 p.; mercury ointment, 90 p.

HYDRARGYRI SUBSULPHAS FLAVUS, U. S.—Yellow Sulphate of Mercury. $Hg(HgO)_2SO_4$; 727.1. (*Basic Mercuric Sulphate. Turpeth Mineral.*)—A heavy, lemon-yellow powder, permanent in the air; odorless and almost tasteless. Made by adding mercuric sulphate to boiling water. Acid mercuric sulphate remains in solution.

HYDRARGYRI SULPHIDUM RUBRUM, U. S.—Red Sulphide of Mercury. HgS; 231.7. (*Red Mercuric Sulphide. Cinnabar.*)—Brilliant, dark-red, crystalline masses, or a fine, bright, scarlet powder, permanent in the air; odorless and tasteless. Made by fusing and subliming mercury and sulphur.

LIQUOR HYDRARGYRI NITRATIS, U. S.—Solution of Nitrate of Mercury. (*Solution of Mercuric Nitrate.*)—A clear, nearly colorless, heavy liquid; specific gravity 2.100; faint odor of nitric acid; strongly acid reaction. Made by dissolving 40 p. red oxide with 45 p. nitric acid and 15 p. water. Contains about 50 per cent. of mercuric nitrate $Hg(NO_3)_2$ with some free nitric acid.

UNGUENTUM HYDRARGYRI NITRATIS, U. S.—Ointment of Nitrate of Mercury. (*Citrine Ointment.*)—Made by treating lard oil with nitric acid, and then incorporating solution of mercuric nitrate. The olein is converted into elaidin, and the color changes to a deep orange, by the action of nitric acid on the lard oil.

ANTIMONY, ARSENIC AND BISMUTH.

ANTIMONY. (STIBIUM.) Sb; 120.

ANTIMONII ET POTASSII TARTRAS, U. S.—Tartrate of Antimony and Potassium. $2KSbOC_4H_4O_6H_2O$; 664. (*Tartar Emetic.*)—Small, transparent crystals of the rhombic system, becoming opaque and white on exposure to air, or a white granular powder; sweet, afterward disagreeable, metallic taste; feebly acid reaction. Made by boiling antimonous oxide and acid potassium tartrate together with water, evaporating and crystallizing.

$$\underset{\text{Acid Potassium Tartrate.}}{2KHC_4H_4O_6} + \underset{\text{Antimonous Oxide.}}{Sb_2O_3} = \underset{\text{Antimony Potassium Tartrate.}}{2KSbOC_4H_4O_6} + \underset{\text{Water.}}{H_2O}.$$

ANTIMONII OXIDUM, U. S.—Oxide of Antimony. Sb_2O_3; 288.—A heavy, grayish-white powder, permanent in the air; odorless and tasteless. Made by adding antimonous chloride to water, and treating the oxychloride formed with water of ammonia.

The process consists of three steps, as follows:—

The first step is the formation of antimonous chloride, $SbCl_3$, with the following reaction:—

$$\underset{\text{Antimony Sulphide.}}{Sb_2S_3} + \underset{\text{Hydrochloric Acid.}}{6HCl} = \underset{\text{Antimonous Chloride.}}{2SbCl_3} + \underset{\text{Hydrosulphuric Acid.}}{3H_2S.}$$

The second step consists of adding the antimonous chloride to water, oxychloride being formed.

$$\underset{\text{Antimonous Chloride.}}{12SbCl_3} + \underset{\text{Water.}}{15H_2O} = \underset{\text{Antimony Oxychloride.}}{2SbCl_3,5Sb_2O_3} + \underset{\text{Hydrochloric acid.}}{30\ HCl.}$$

The third step consists in converting the oxychloride into oxide, by treating it with ammonia.

$$\underset{\text{Antimony Oxychloride.}}{2SbCl_3,5Sb_2O_3} + \underset{\text{Ammonia.}}{6NH_3} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Antimony Oxide.}}{6Sb_2O_3} + \underset{\text{Ammonium Chloride.}}{6NH_4Cl.}$$

ANTIMONII SULPHIDUM, U. S.—Sulphide of Antimony. Sb_2S_3; 336. (*Antimonii Sulphuretum. Pharm. 1870.*)—Native sulphide of antimony, purified by fusion, and as nearly free from arsenic as possible.

Steel-gray masses, of a metallic lustre, and a striated, crystalline fracture, forming a black or grayish-black, lustreless powder; odorless and tasteless.

ANTIMONII SULPHIDUM PURIFICATUM, U. S.—Purified Sulphide of Antimony. Sb_2S_3; 336.—A dark-gray powder; odorless and tasteless. Prepared by macerating antimonous sulphide with water containing a trace of water of ammonia.

ANTIMONIUM SULPHURATUM, U. S.—Sulphurated Antimony.—A reddish-brown, amorphous powder; odorless and tasteless. Made by boiling antimonous sulphide with solution of soda, and adding sulphuric acid to the hot solution.

This process consists of two steps. *First*, the formation of sodium antimonite by the action of sodium hydrate on antimonous sulphide.

$$\underset{\text{Antimonous Sulphide.}}{Sb_2S_3} + \underset{\text{Sodium Hydrate.}}{6NaHO} = \underset{\text{Sodium Antimonite.}}{Na_3SbO_3} + \underset{\text{Sodium Sulph-Antimonite.}}{NaSbS_3} + \underset{\text{Water.}}{3H_2O.}$$

Second, decomposition of sodium antimonite and sodium sulph-antimonite by sulphuric acid:—

$$\underset{\text{Sodium Antimonite.}}{2Na_3SbO_3} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} = \underset{\text{Sodium Sulphate.}}{3Na_2SO_4} + \underset{\text{Antimonous Oxide.}}{Sb_2O_3} + \underset{\text{Water.}}{3H_2O.}$$

And—

$$\underset{\text{Sodium Sulph-antimonite.}}{2Na_3SbS_3} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} = \underset{\text{Sodium Sulphate.}}{3Na_2SO_4} + \underset{\text{Antimonous Sulphide.}}{Sb_2S_3} + \underset{\text{Hydrosulphuric Acid.}}{3H_2S.}$$

PILULÆ ANTIMONII COMPOSITÆ, U. S. — **Compound Pills of Antimony.** (*Plummer's Pills.*)—Each contains one half grain sulphurated antimony, one-half grain calomel, and one grain guaiac. (See Pilulæ, Part II.)

PULVIS ANTIMONIALIS, U. S. — **Antimonial Powder.** (*James' Powder.*)—33 p. antimonous oxide; 67 p. precipitated calcium phosphate. (See Pulveres, Part II.)

VINUM ANTIMONII, U. S.—**Wine of Antimony.**—4 p. tartar emetic; 60 p. distilled water; stronger white wine to make 1000 parts. (See Vina, Part II.)

ARSENIC. As; 74.9.

ACIDUM ARSENIOSUM, U. S.—**Arsenious Acid.** As_2O_3; 197.8. (*Arsenious Oxide. White Arsenic.*)—A heavy, white solid, occurring either as an opaque powder, or in transparent or semi-transparent masses, which usually have a striated appearance; odorless; tasteless; faintly acid reaction. Prepared by roasting arsenical ores, and resubliming the sublimate.

The oxide (As_2O_3) becomes an acid (H_3AsO_3) when added to water.

$$\underset{\text{Arsenious Oxide.}}{2As_2O_3} + \underset{\text{Water.}}{6H_2O} = \underset{\text{Arsenious Acid.}}{4H_3AsO_3}.$$

LIQUOR ACIDI ARSENIOSI, U. S.—**Solution of Arsenious Acid.** (*Liquor Arsenici Chloridi. Pharm. 1870.*)—A solution of arsenious acid in diluted hydrochloric acid. 1 p. arsenic; 2 p. HCl; distilled water to 100 parts. No chemical reaction takes place.

LIQUOR POTASSII ARSENITIS, U. S.—**Solution of Arsenite of Potassium.** (*Fowler's Solution.*)—1 p. arsen. acid; 1 p. $KHCO_3$; 3 p. tr. lavender comp.; distilled water to 100 parts.

$$\underset{\substack{\text{Acid Potassium}\\ \text{Carbonate.}}}{2KHCO_3} + \underset{\substack{\text{Arsenious}\\ \text{Oxide.}}}{As_2O_3} + \underset{\text{Water.}}{H_2O} = \underset{\substack{\text{Potassium}\\ \text{Arsenite.}}}{2KH_2AsO_3} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{2CO_2}.$$

When arsenious oxide is boiled with $KHCO_3$ in concentrated solution, potassium arsenite is produced, and CO_2 evolved. The quantity of water directed in the formula, however, is sufficient to dissolve the salts, so that a solution can be effected without any chemical change.

SODII ARSENIAS, U. S.—**Arseniate of Sodium.** $Na_2HAsO_4.7H_2O$; 311.9.—Made by fusing arsenious acid with sodium nitrate and carbonate.

LIQUOR SODII ARSENIATIS, U. S.—(See Liquores, Part II.)

ARSENII IODIDUM, U. S.—**Iodide of Arsenic.** AsI_3; 454.7. (*Arsenici Iodidum. Pharm. 1870.*)—Glossy, orange-red, crystalline masses, or shining, orange-red, crystalline scales, gradually losing iodine when exposed to the air; iodine-like odor, iodine-like taste; neutral reaction. Made by fusing 1 p. of arsenic and 5 p. of iodine together.

LIQUOR ARSENII ET HYDRARGYRI IODIDI, U. S.—**Solution of Iodide of Arsenic and Mercury.** (*Liquor Arsenici et Hydrargyri Iodidi. Pharm. 1870. Donovan's Solution.*)—Solution should be light straw-color; if darker, free iodine is probably present. (See Liquores, Part II.)

BISMUTH. Bi; 210.

BISMUTHI CITRAS, U. S.—Citrate of Bismuth. $BiC_6H_5O_7$; 399.—A white, amorphous powder, permanent in the air; odorless and tasteless. Prepared by boiling bismuth subnitrate with citric acid and water, and adding distilled water to the clear solution. The reaction is as follows:—

$$\underset{\text{Bismuth Subnitrate.}}{BiONO_3.H_2O} + \underset{\text{Citric Acid.}}{H_3C_6H_5O_7} = \underset{\text{Bismuth Citrate.}}{BiC_6H_5O_7} + \underset{\text{Nitric Acid.}}{HNO_3} + \underset{\text{Water.}}{2H_2O}.$$

BISMUTHI ET AMMONII CITRAS, U. S.—Citrate of Bismuth and Ammonium.—Small, shining, pearly or translucent scales, becoming opaque on exposure to air; odorless; slightly acidulous and metallic taste; neutral or faintly alkaline reaction. Made by dissolving bismuth citrate in water of ammonia, evaporating the solution, and scaling.

BISMUTHI SUBCARBONAS, U. S.—Subcarbonate of Bismuth. $(BiO)_2CO_3.H_2O$; 530.—A white, or pale, yellowish-white powder, permanent in the air; odorless and tasteless. Made by dissolving bismuth in nitric acid, purifying and precipitating by adding solution of sodium carbonate.

The most injurious impurity in bismuth is arsenic. In the officinal formula, directions are carefully made to leave out the arsenic. "The bismuth is first dissolved in nitric acid, a portion of which oxidizes the metal, with evolution of nitrous vapors, while another portion combines with the oxide produced, to form a bismuth nitrate. At the same time the arsenic is also oxidized at the expense of the nitric acid, and unites with a portion of the oxidized metal, so as to produce bismuth arseniate. Both of these salts, therefore, are contained in the solution, which is very concentrated. Both have the property, when their solution is diluted with water, of separating into two salts—one an insoluble subsalt, which is deposited, and the other a soluble acid salt, which is held in solution. But the arseniate is more disposed to the change than the nitrate, and requires for the purpose a smaller amount of water of dilution. The subarseniate is slowly deposited in twenty-four hours, and is then separated by filtration. The addition of a large quantity of distilled water precipitates the bismuth subnitrate, the ammonia being added to separate it more thoroughly by combining with the nitric acid. The precipitate thus freed from arsenic is now redissolved in nitric acid, partially diluted, and added to solution of sodium carbonate; by double decomposition bismuth subcarbonate and sodium nitrate are thus produced."—(Remington.)

BISMUTHI SUBNITRAS, U. S.—Subnitrate of Bismuth. $BiONO_3.H_2O$; 306.—A heavy, white powder, permanent in the air; odorless; almost tasteless; slightly acid reaction. Prepared by dissolving bismuth in nitric acid, purifying and adding the solution, in nitric acid, to water. The reactions are as follows:—

$$\underset{\text{Bismuth.}}{Bi_2} + \underset{\text{Nitric Acid.}}{8HNO_3} = \underset{\text{Bismuth Nitrate.}}{(Bi3NO_3)_2} + \underset{\text{Water.}}{4H_2O} + \underset{\text{Nitrogen Monoxide.}}{2NO};$$

then,

$$\underset{\text{Bismuth Nitrate.}}{5(Bi3NO_3)} + \underset{\text{Water.}}{8H_2O} = \underset{\text{Bismuth Subnitrate.}}{4BiONO_3H_2O} + \underset{\text{Bismuth Nitrate.}}{Bi3NO_3} + \underset{\text{Nitric Acid.}}{8HNO_3}.$$

"The separation of the arsenic is accomplished by first preparing the carbonate, by adding the solution of bismuth to a solution of sodium carbonate in excess, whereby most of the arsenic is retained in the solution, probably as sodium arseniate, while the insoluble carbonate is precipitated. This is dissolved, with the aid of heat, in nitric acid, so as to make a very concentrated solution of the nitrate, to which, when cold, just so much water is added as to begin to produce a permanent turbidness. The object of this is to allow any arsenic that may be still present to be deposited, which happens for reasons explained above. (See Subcarbonate.) The deposited matter having been precipitated, only the pure nitrate remains in solution, which is made to yield the subnitrate by a large dilution with water, and still more completely, by the addition of ammonia."—(Remington.)

GOLD AND PLATINUM.

Au; 196.2. Pt; 194.4.

AURI ET SODII CHLORIDUM, U. S.—Chloride of Gold and Sodium.—An orange-yellow powder, slightly deliquescent in damp air; odorless; saline, metallic taste; slightly acid reaction. A mixture composed of equal parts of dry chloride of gold ($AuCl_3$) and chloride of sodium (NaCl). Made by dissolving gold in nitrohydrochloric acid, evaporating to dryness, weighing and dissolving in eight times its weight of distilled water. Pure decrepitated common salt, equal in weight to the dry chloride, is then added, previously dissolved in four parts of water. The mixture is then evaporated to dryness, with constant stirring.

TEST-SOLUTION OF PLATINIC CHLORIDE.—1 p. chloride; 20 p. distilled water.

PART IV.

THE PREPARATIONS OF THE ORGANIC MATERIA MEDICA.

What is Organic Chemistry? *The science of the carbon compounds.*

The following pages treat of both officinal and non-officinal organic substances, and the former may be distinguished from the latter by the letters U. S. following the officinal names.

THE CELLULIN GROUP.

CELLULIN. $C_6H_{10}O_5$.

What is cellulin or cellulose? The woody fibre of plants, forming the skeleton for the vegetable tissues.

What is lignin? "The substances which are found adhering to the cellulin skeleton of plants and vegetable tissues."

Describe pure cellulin. It is seen in the pure condition in raw cotton, the hairs of the seed of the cotton plant, and in many vegetable products. It is white, translucent, unalterable in the air; sp. gr., 1.5; insoluble in all the usual solvents, but soluble in ammoniacal solution of oxide of copper; converted into dextrin by treating with strong sulphuric or phosphoric acid, and, further, converted into glucose if the mixture be diluted with water and heated.

What is parchment-paper? Cellulin, in the form of unsized paper, after treatment with a mixture consisting of 2 p. H_2SO_4, sp. gr. 1.840, and 1 p. H_2O, by measure, cooled to 15° C. (59° F.), and washing in dilute AmHO.

For what is parchment-paper used in pharmacy? As a septum for dialysis.

What important principle in pharmacy is owing to the insolubility of cellulin in ordinary solvents? As cellulin forms the bulk of inert matter in plants, and is insoluble in ordinary solvents, active principles soluble in such solvents can be readily separated from it.

When used for the purpose of separating the active principles in plants from the inert cellulin, what are solvents called? Menstrua.

GOSSYPIUM, U. S.—Cotton. (*Purified Cotton. Absorbent Cotton.*)—Cotton freed from the trace of fatty matters always existing in raw cotton, by boiling it in a weak alkaline solution, rinsing it in a weak solution of chlorinated lime, to whiten it, dipping it in a very dilute solution of HCl, washing with cold water, drying, and carding. The loss is about 10 per cent.

Products Resulting from the Decomposition of Cellulin.

CLASS I.—PRODUCTS MADE BY DECOMPOSING CELLULIN OR LIGNIN BY THE ACTION OF ACIDS OR ALKALIES.

PYROXYLINUM, U. S.—Pyroxylin. (*Pyroxylon, Pharm., 1870.*) *Soluble Gun-cotton.*—A very inflammable, slightly explosive substance, resembling cotton, formed by acting on cotton 1 p. with nitric acid 10 p., and sulphuric acid 12 p., for ten hours, or until a portion taken out is found soluble in a mixture consisting of 1 p. alcohol, 3 p. str. ether (by volume), after which it is washed and dried.

What is Pyroxylinum chemically? Di-nitro-cellulin. $C_6H_8(2NO_2)O_5$.

Explain its formation. It belongs to a series of nitro-compounds of cellulin, formed by the action of nitric acid on this substance, by which nitrogen dioxide is substituted for one, two, or three of its hydrogen atoms, as follows:—

1. $HNO_3 + C_6H_{10}O_5 = C_6H_9(NO_2)O_5 + H_2O.$
2. $2HNO_3 + C_6H_{10}O_5 = C_6H_8(2NO_2)O_5 + 2H_2O.$
3. $3HNO_3 + C_6H_{10}O_5 = C_6H_7(3NO_2)O_5 + 3H_2O.$

1. Insoluble in mixture of ether and alcohol. Non-explosive.
2. Soluble " " " " " Slightly explosive. Officinal.
3. " " " " " " Highly explosive (gun-cotton).

ACIDUM OXALICUM.—Oxalic Acid. $H_2C_2O_4 2H_2O$; 126.—Small, colorless, prismatic crystals; odorless, and with a very sour taste.

Made by acting on cellulin, sugar or starch, with nitric acid; but prepared on a commercial scale by heating sawdust with a mixture of two molecules caustic soda and one molecule potassa. The gray mass resulting is washed with Na_2CO_3; whereby the potash is removed as carbonate, and the less soluble sodium oxalate remains. This is converted into calcium oxalate by milk of lime, and then decomposed with H_2SO_4 and purified by recrystallization.

Products Resulting from the Destructive Distillation of Cellulin and Lignin.

What occurs when wood is distilled in close vessels without air? Several solid, liquid and gaseous products are formed, of which the principal ones are the following:—

SOLIDS.—Charcoal, inorganic salts, etc. LIQUIDS.—1. Aqueous liquid, containing *acetic, formic, butyric, crotonic, capronic, propionic acids, acetone, methylic alcohol, furfurol, methylamine, pyrocatechin*, and small quantities of empyreumatic oils and resins. 2. Tarry liquid, containing *toluol, xylol, cumol, methol, mesitylene, pseudocumol, phenol, cresol, guaiacol, creasol, phlorol*, and *methylcreasol, naphthalene, paraffin, pyrene, chrysene, retene, mesit.* GASES.—*Carbon dioxide, carbon monoxide, marsh gas, acetylene, ethylene, propene*, and others.

Which are the most important of these? Charcoal, tar, acetic acid, acetone, methylic alcohol, and creasote.

ACIDUM ACETICUM, U. S.—Acetic Acid. $HC_2H_3O_2$; 60.—A clear, colorless liquid, with a distinctly vinegar-like odor, and purely acid taste, composed of 36 per cent. absolute acetic acid and 64 per cent. water. Made by distilling oak wood at a temperature much less than that necessary to produce charcoal.

Acetic acid is also made by distilling *vinegar*, which, in turn, is made by oxidizing dilute alcoholic liquids. In Germany it is made by oxidizing alcohol, by pouring a very dilute alcoholic solution on beechwood shavings, which exposes a large surface to the air.

What two strengths of acetic acid are found in commerce? The officinal acid and No. 8 acid. The former has a specific gravity of 1.048, the latter 1.040, and is 20 per cent. weaker. It is called No. 8 acid because it was formerly used in the proportion of 1 to 8, to make dilute acetic acid or distilled vinegar.

ACIDUM ACETICUM DILUTUM, U.S.—Diluted Acetic Acid.—The liquid used as the menstruum for the officinal vinegars, containing 6 per cent. absolute $HC_2H_3O_2$; specific gravity 1.0083. Made by diluting 17 p. acetic acid with 83 p. distilled water, to make 100 parts.

ACIDUM ACETICUM GLACIALE, U. S.—Glacial Acetic Acid. $HC_2H_3O_2$; 60.—At or below 15° C. (59° F.), a crystalline solid; at higher temperatures, a colorless liquid; sp. gr., 1.056 to 1.058, at 15° C. (59° F.). Made by heating sodium acetate until the water of crystallization has been driven off, powdering the residue, and distilling it with concentrated sulphuric acid. The reaction is as follows:—

$NaC_2H_3O_2$	+	H_2SO_4	=	$HC_2H_3O_2$	+	$NaHSO_4$.
Sodium Acetate.		Sulphuric Acid.		Glacial Acetic Acid.		Acid Sodium Sulphate.

PIX LIQUIDA, U. S.—Tar.—An empyreumatic oleoresin, obtained by the destructive distillation of the wood of *Pinus Palustris* and of other species of *Pinus*. It is usually obtained as a by-product in the manufacture of charcoal or acetic acid.

Officinal Description.—Thick, viscid, semi-fluid, blackish-brown, heavier than water, transparent in thin layers, becoming granular or opaque by age; having an acid reaction, an empyreumatic terebinthinate odor, and a sharp, empyreumatic taste; slightly soluble in water, soluble in alcohol, in fixed or volatile oils, and in solution of potassa or of soda.

Syrupus Picis Liquidæ, U. S.—Syrup of Tar.

Unguentum Picis Liquidæ, U. S.—Tar Ointment.

OLEUM PICIS LIQUIDÆ, U. S.—Oil of Tar.—An almost colorless liquid, distilled from tar, soon acquiring a dark, reddish-brown color when exposed to the air; having a strong, tarry odor and taste, and acid reaction; specific gravity about 0.970.

Black Pitch.—The residue left after the distillation of tar.

CREASOTUM, U. S.—Creasote.—An almost colorless or yellowish, strongly refractive, oily liquid, turning to reddish-yellow or brown by exposure to light; penetrating, smoky odor; burning, caustic taste; neutral reaction; specific gravity 1.035 to 1.085.

Creasote is a production of the distillation of wood tar, consisting, mainly, of the following phenols: *guaiacol*, or *oxycresol*, $C_7H_8O_2$, boiling at 200° C. (392° F.); *creasol*, $C_8H_{10}O_2$, boiling at 217° C. (422.6° F.); *methylcreasol*, $C_9H_{12}O_2$, boiling at 214° C. (417° F.) to 218 C. (424.4° F.); *phlorol*, $C_8H_{10}O_1$, boiling at 219° C. (426.2° F.).

When wood tar is distilled, a solution of several layers is formed. The lower, oily layer is treated with K_2CO_3, to neutralize the acid present. Fractional distillation, with alternate treatment of the distillate with H_2SO_4 and KHO, to separate impurities, and final distillation, yields the product called creasote, which comes over between 205° and 220° C. (401° and 428° F.).

Nearly all of the liquid sold for creasote in the market is impure carbolic acid or coal-tar creasote. It is distinguished from true wood creasote in the following manner: Creasote does not coagulate albumen or collodion. (For other tests, see U. S. P.)

Aqua Creasoti. U. S.—Creasote Water.

Products Resulting from the Natural Decomposition of Cellulin and Lignin and their Derivatives.

Coal.—A fossil formation found in the earth, formed by the decomposition of cellulin, lignin, etc., under the changing influence of moisture, temperature and pressure.

Coal Tar.—A residue left after the dry distillation of bituminous coal in the process of making illuminating gas. It consists of a large number of products in the form of solids, liquids and gases, a number of which form very valuable products in the arts.

OLEUM SUCCINI, U. S.—Oil of Amber.—Amber is a fossil residue of an extinct coniferous wood, found principally on the Baltic coast. Its volatile oil is obtained by the destructive distillation of amber, and purified by subsequent rectification.

Describe It.—It is a pale, yellow liquid, having an empyreumatic odor and a warm, acrid taste; specific gravity, 0.920; soluble in alcohol, and converted into a brown resinous mass, known as artificial musk, by fuming nitric acid.

ACIDUM CARBOLICUM CRUDUM, U. S.—Crude Carbolic Acid.—A liquid obtained during the distillation of coal-tar, between the temperatures of 170° to 190° C. (338° and 374° F.), and containing carbolic and cresylic acids in variable proportions, together with other substances.

Officinal Description.—A nearly colorless or reddish brown liquid, of a strongly empyreumatic and disagreeable odor, having a benumbing, blanching and caustic effect on the skin or mucous membrane, and a neutral reaction.

ACIDUM CARBOLICUM, U. S.—Carbolic Acid. C_6H_5HO; 94. (*Phenol.*)—Colorless, interlaced, needle-shaped crystals, sometimes acquiring a pinkish tint; deliquescent on exposure. It produces a benumbing, blanching and caustic effect on the skin. It has a distinctive, slightly aromatic odor, resembling creasote; when diluted, a sweetish taste, with a slightly burning after-taste; neutral reaction; and is a product of the distillation of coal-tar between the temperatures of 180° and 190° C. (356° and 374° F.).

Unguentum Acidi Carbolici, U. S.—Ointment of Carbolic Acid.

ACIDUM SALICYLICUM, U. S.—Salicylic Acid. $HC_7H_5O_3$; 138.—Fine, white, light, prismatic, needle-shaped crystals, permanent in the air; free from odor of carbolic acid; having, sometimes, a slight aromatic odor; sweetish and slightly acrid taste; acid reaction. Prepared by treating sodium phenol (or carbolate) with carbon dioxide. The sodium phenol is prepared by evaporating to dryness equal amounts of concentrated caustic soda solution and phenol; this is then heated to 100° C. (212° F.), while a stream of dry CO_2 is passed over it. The temperature is gradually raised as soon as the phenol distills over, until it reaches 250° C. (482° F.), until no more phenol distills. Half of the phenol used remains in the retort, as sodium salicylate, while the other half distills over unchanged. The reaction is as follows:—

$$\underset{\text{Sodium Phenol.}}{2NaC_6H_5O} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2} = \underset{\text{Phenol.}}{C_6H_6O} + \underset{\substack{\text{Normal Sodium}\\\text{Salicylate.}}}{Na_2C_7H_4O_3}.$$

The normal sodium salicylate thus obtained is then decomposed by HCl, and the salicylic acid is filtered out, washed and crystallized, or purified by sublimation and superheated steam or by dialysis.

AMYLACEOUS AND MUCILAGINOUS PRINCIPLES AND THEIR PRODUCTS.

AMYLUM, U. S.—Starch.—The fecula of the seed of *Triticum vulgare*, occurring in irregular, angular masses, which are easily reduced to powder; of a white color; under the microscope, appearing as granules, mostly very minute, more or less lenticular in form and indistinctly, concentrically striated. Inodorous and tasteless.

Starch is present in many drugs and is an important constituent of many vegetable foods. It is usually made from potatoes by separating the cellu-

lar substance from the starch, by grating and pressing the soft mass upon a sieve, the starch granules falling through. It may be, also, prepared from wheat or corn, by allowing the grain to ferment, which disintegrates it, and stopping the fermentation before the starch is affected. The quality of starch depends largely upon the quality and purity of the water used in washing it.

Chemical Composition of Starch.—It has the same chemical composition as cellulin, $C_6H_{10}O_5$, and is closely allied to it and its properties.

Office of Starch in the Vegetable Kingdom.—It is stored up in plants as a food, in anticipation of future usefulness in the formation of plant tissues.

Description of the Starch Granule.—In young plants the starch granule is always spherical, but it subsequently becomes ovoid, lenticular, polyhedral or irregular in shape. Various plants exhibit characteristic starch granules peculiar to each, which may be identified by the microscope. The granule occurs in concentrically arranged layers of different densities, arranged around a central point, usually situated at one end of the granule, and called the *hilum*.

AMYLUM IODATUM, U. S.—Iodized Starch.—Starch containing 5 per cent. of iodine.

GLYCERITUM AMYLI, U. S.—Glycerite of Starch. (*Starch Jelly.*)—10 p. starch; 90 p. glycerine.

MALTUM U. S.—Malt.—The seed of *hordeum distichum*, caused to enter the incipient stage of germination by artificial means, and dried.

Barley is steeped in water until it swells and becomes tender. It is then spread thickly on a stone floor, where it heats spontaneously and germinates. The germination is now partially stopped by spreading it more thinly. It is then raked into heaps and allowed to stand for a day, when it becomes hot. Afterward, it is dried in a kiln.

Object of "Malting" Grain.—During the process of germination, the starch of the grain is converted into *maltose* (a peculiar kind of sugar) and *dextrin*, owing to the presence of *diastase*, a peculiar and powerful ferment developed during the process. The starch remaining after this fermentation is further converted into maltose during the heating in the kiln.

Diastase.—Malt usually contains about two parts in a thousand of diastase, which may be prepared from it by bruising fresh malt, adding about half its weight of water, expressing strongly, treating the viscid liquid thus obtained with sufficient alcohol to destroy its viscidity, then separating the coagulated albumen, and adding a fresh portion of alcohol, which precipitates the diastase in an impure state. To render it pure, it must be redissolved as often as three times in water, and precipitated by alcohol.

Property of Diastase.—It has the property of converting starch into dextrin and maltose. Only about one part in two thousand of starch, suspended in water, is required. The mixture should be maintained at a temperature of about 71.1° C. (160° F.).

Malt is used in Medicine in the forms of extract of malt, malt foods, etc. It is useful, first, as a food; second, as a digestive, owing to the diastase it contains and its peculiar property.

EXTRACTUM MALTI, U. S.—Extract of Malt.—Occurring in the form of a thick, honey-like extract. Made by macerating and digest-

ing 100 p. malt with cold water, and then with water at a temperature of 51° C. (135° F.), straining and evaporating *in vacuo*.

CETRARIA, U. S.—Cetraria. (*Iceland Moss.*)—A lichen found in northern latitudes, on both continents, named *cetraria islandica*, containing 70 per cent. *lichenin*, $C_{12}H_{20}O_{10}$ (strongly allied to starch, which swells up in water); about 3 per cent. *cetraric acid*, $C_{18}H_{16}O_8$ (crystalline and very bitter); *lichenstearic acid*, $C_{14}H_{34}O_3$; sugar, oxalic acid, fumaric acid and cellulin.

DECOCTUM CETRARIÆ, U. S.—Decoction of Cetraria.—(See Decocta, Part II.)

In the officinal process for this preparation, the cetraria is first macerated with water, and expressed before it is finally boiled with water, to separate the bitter principle, cetraric acid.

CHONDRUS, U. S.—Chondrus. (*Irish Moss.*)—An alga growing in the Atlantic Ocean, named *Chondrus crispus*, containing 70 per cent. *carrageenin*, a mucilaginous principle, differing from gum by not precipitating with alcohol; from starch, by not becoming blue with iodine; and from pectin, by not precipitating with subacetate of lead.

GUMS AND MUCILAGINOUS SUBSTANCES.

Gum, now known by the name *arabin*, is a vegetable substance, forming a thick, glutinous liquid with water; insoluble in alcohol, and converted into mucic and oxalic acid with nitric acid.

Three Proximate Principles found in Gums.—Arabin, or arabic acid, $C_{12}H_{22}O_{11}$ (soluble), found in acacia; bassorin, $C_{12}H_{20}O_{10}$ (insoluble), found in tragacanth; cerasin (insoluble), found in cherry gum.

Gums differ from starch or cellulin by being soluble in water or by swelling up in contact with it.

They differ from sugar by being incapable of vinous fermentation with yeast.

ACACIA, U. S.—Acacia. (*Gum Arabic.*)—A gummy exudation from *Acacia Verek* and from other species of *Acacia*, consisting, mainly, of calcium, potassium or magnesium arabate; occurring in roundish or amorphous pieces, or irregular fragments of various sizes, more or less transparent, hard, brittle, pulverizable and breaking with a shining fracture. It is usually white or yellowish-white, but frequently presents different shades of red, and is sometimes of a deep orange or brownish color. It is bleached by exposure to the sun. In powder it is always white. It is inodorous, has a feeble, slightly sweetish taste, and, when pure, dissolves in the mouth; specific gravity, 1.31 to 1.525. At ordinary temperatures, it forms a thick, glutinous liquid, of distinctly acid reaction when dissolved in water. It does not precipitate with neutral lead acetate, but the basic acid forms a precipitate, even with dilute solution. Solutions of ferric salts, silicates and borates render gum solution turbid or thicken it to jelly. Iodine, silver and mercuric chloride produce no alteration. Ammoniacal solution of cupric oxide dissolves it.

MUCILAGO ACACIÆ, U. S.—Mucilage of Acacia.—(See Mucilagines, Part II.)

SYRUPUS ACACIÆ, U. S.—Syrup of Acacia.—(See Syrupi, Part II.)

TRAGACANTHA, U. S.—Tragacanth.—A gummy exudation from *Astragalus gummifer* and from other species of *Astragalus*, consisting of 33 per cent. of bassorin, 53 per cent. soluble gum (not arabin), 11 per cent. water, 3 per cent. impurities; occurring either in flaky, leaf like pieces or in tortuous, vermicular filaments, of a whitish color, somewhat translucent and resembling horn in appearance; hard, and more or less fragile, but difficult of pulverization unless exposed to a freezing temperature or thoroughly dried and powdered in a heated mortar; odorless; very little taste; sp. gr. 1.384; introduced into water, it absorbs a certain proportion, swells very much, and forms a soft adhesive paste, but does not dissolve; agitated with an additional quantity of water, this paste forms a uniform mixture; but in the course of one or two days, the greater part separates, and is deposited, leaving a portion dissolved in the supernatant fluid; the gelatinous mass is turned blue by iodine, and the fluid portion is not precipitated by alcohol; wholly insoluble in alcohol. Tragacanth appears to be composed of two different constituents, one resembling acacia, soluble in water; the other insoluble, but swelling in water. The former differs from acacia in affording no precipitate with potassium silicate or ferric chloride.

MUCILAGO TRAGACANTHÆ, U. S.—Mucilage of Tragacanth.—(See Mucilagines, Part II.)

ULMUS, U S.—Elm. (*Slippery Elm.*)—The inner bark of *Ulmus fulva*, containing a mucilage precipitated by alcohol and lead acetate.

Mucilago Ulma, U. S.—Mucilage of Elm.

SASSAFRAS MEDULLA, U. S.—Sassafras Pith.—The pith of *Sassafras officinalis*, containing a delicate mucilage, which is not precipitated by alcohol.

Mucilago Sassafras Medullæ, U. S.—Mucilage of Sassafras Pith.

CYDONIUM, U. S.—Cydonium. (*Quince Seed.*)—The seed of *Cydonia vulgaris*, containing about 20 per cent. of a peculiar mucilage, not precipitated by borax.

Mucilago Cydonii, U. S.—Mucilage of Cydonium.

ALTHÆA, U. S.—Althæa. (*Marshmallow.*)—The root of *Althæa officinalis*, containing a large quantity of mucilage, $C_{12}H_{20}O_{10}$, associated with *asparagin*, sugar and starch.

Syrupus Althæa, U. S.—Syrup of Althæa.

LINUM, U. S.—Flax Seed. (*Linseed.*)—The seed of *Linum usitatissimum*, containing 15 per cent. mucilage, $C_{12}H_{20}O_{10}$, in the epithelium, and 20 to 35 per cent. fixed oil in the nucleus, besides resin, sugar, wax, etc. The mucilage is soluble in water, readily soluble in hot water, forming a thick, viscid liquid, precipitated by alcohol and subacetate of lead.

SUGARS AND SACCHARINE SUBSTANCES.

Sugars are organic bodies, having a sweet taste, generally of vegetable origin and crystallizable; of a neutral reaction; soluble in water, their solutions being optically active to polarized light.

Two Classes of Sugar.—Fermentable and non-fermentable sugars.

1. **FERMENTABLE SUGARS** are the more important, being largely consumed in food products. The fermentable sugars are divided into two sub-classes—*glucoses*, or sugars *directly* subject to vinous fermentation, and *saccharoses*, or sugars *indirectly* subject to vinous fermentation.

GLUCOSES. $C_6H_{12}O_6$.—The formula for the *glucoses* is $C_6H_{12}O_6$. The principal ones are—*glucose* (dextro-glucose or dextrose), which rotates the plane of polarization strongly to the right; obtained by treating starch with H_2SO_4 and lime, separating the $CaSO_4$, and evaporating the solution. *Grape sugar* (crystallized glucose); obtained by crystallizing the above solution. *Lævulose* (lævo-glucose) rotates the plane of polarization strongly to the left; found in sugar cane. *Maltose*, $C_{12}H_{22}O_{11} + H_2O$; obtained by action of diastase on starch, etc.

GLUCOSE, $C_6H_{12}O_6$, is prepared by the action of dilute H_2SO_4 upon starch. It may also be obtained from candied sugar, grapes and other sources. Glucose is the term applied to the syrupy preparation, grape sugar to the solid product. The process is as follows: Corn is first soaked in warm water, then ground with a stream of water, the starch washed from the meal in a trough with bolting cloth bottom, beaten with caustic soda, to separate the gluten, washed, and treated with dilute H_2SO_4 and steam. This process is called "open conversion," and takes about two hours. Or the substances are acted upon with superheated steam, in a closed cylinder. This is called "close conversion," and takes about fifteen minutes. After conversion, the substances are treated with marble dust and animal charcoal, filtered, and evaporated in *vacuo*.

Glucose can be obtained as a hydrate, in small and laminated crystals, from aqueous solutions, and anhydrous in hard, crystalline masses, either from alcoholic solution or from very concentrated aqueous solution.

Properties.—Less sweet than cane sugar; less soluble in water, more soluble in alcohol; sp. gr. 1.54–1.57, when anhydrous. Strong mineral acids act sparingly on it, but with facility on cane sugar. Alkalies readily destroy it, but form definite compounds with cane sugar. Boiled with water, it suffers very little alteration; rotates polarized light to the right; undergoes vinous fermentation directly; reduces alkaline tartrate of copper, producing a reddish precipitate.

SACCHAROSE, $C_{12}H_{22}O_{11}$. The peculiar characteristic of sugars of this class is, that they are fermentable only after being converted into glucoses.

Principal Saccharoses.—Cane sugar (saccharose), from sugar cane, beets, etc.; para-saccharose, by fermenting spontaneously cane sugar; milk sugar (lactose, lactin), from milk.

2. **NON-FERMENTABLE SUGARS.** (Sometimes called saccharoids.)

Principal non-fermentable sugars. Mannit, $C_6H_{14}O_6$; dulcit, $C_6H_{14}O_6$; eucalyn; inosit, etc., etc.

SACCHARUM, U. S.—Sugar. $C_{12}H_{22}O_{11}$; 342.—The refined sugar of *Saccharum officinarum*, made, commercially, from sugar cane, beet root and sorghum; occurring in white, dry, hard, distinctly crystalline granules, permanent in the air; odorless; purely sweet taste; neutral reaction. Prepared by crushing and expressing sugar cane, adding calcium bisulphite and a little lime, heating, straining, evaporating, cooling and

stirring, transferring to casks, perforated at the bottom, and the crystals drained. This is known as the open-pan process. The vacuum-pan process, which now almost completely displaces it, consists in removing the lime by CO_2, filtering through bone black, concentrating in a vacuum-pan, crystallizing, and drying the crystals in "centrifugals" by rapid revolutions.

The best sugar for pharmaceutical uses is granulated sugar, as it is not liable to absorb moisture, like loaf sugar, and does not lose weight when kept in dry air.

Rock Candy.—Crystallized sugar. Sp. gr. 1.606.

MEL, U. S.—Honey.—A saccharine secretion deposited in the honeycomb by *Apis mellifica*, and occurring as a syrupy liquid, of a light yellowish or pale, brownish-yellow color, translucent, gradually becoming crystalline and opaque; characteristic odor; sweet; faintly acrid taste.

MANNA, U. S.—Manna.—A concrete, saccharine exudation of *Fraxinus ornus*, usually occurring of a yellowish-white color externally; internally white, porous and crystalline; sp. gr. 0.834. When pure, it is soluble in three parts of cold water and its own weight of boiling water. It separates, in crystalline masses, from a boiling saturated aqueous solution; soluble in alcohol, and depositing, from a boiling alcoholic solution, beautiful crystals of a peculiar, sweet principle found in manna and many other plants, called *mannit*.

GLYCYRRHIZA, U. S.—Glycyrrhiza. (*Licorice Root.*)—The root of *glycyrrhiza glabra*, containing the sweet principle *glycyrrhizin*, or *glycyrrhizic acid*, $C_{44}H_{63}NO_{18}$, existing in the root, in combination with ammonium.

Extractum Glycyrrhizæ, U. S.—Extract of Glycyrrhiza.

Extractum Glycyrrhizæ Purum, U. S.—Pure Extract of Glycyrrhiza.

Pulvis Glycyrrhizæ Compositus, U. S.—Compound Powder of Glycyrrhiza.

Extractum Glycyrrhizæ Fluidum, U. S.—Fluid Extract of Glycyrrhiza.

GLYCYRRHIZINUM AMMONIATUM, U. S.—Ammoniated Glycyrrhizin.—Made by percolating licorice root with water, adding H_2SO_4 as long as a precipitate is produced, and redissolving the precipitate in water, with the aid of AmHO, and scaling. Yield, about 10 per cent.

TRITICUM, U. S.—Triticum. (*Couch Grass.*)—The rhizome of *Triticum repens*, gathered in the spring, and deprived of the rootlets, containing *triticin*, a principle resembling inulin, also glucose, lævulose, etc.

Extractum Tritici Fluidum, U. S.—Extract of Triticum.

DERIVATIVES OF SUGAR THROUGH THE ACTION OF FERMENTS.

Fermentation.—Decomposition occurring in organic bodies on exposure to the action of moisture, air and a warm temperature, resulting in the formation of new products. When the products are worthless or offensive, the process is called *putrefaction*; when useful, it is called *fermentation*.

Cause of Fermentation.—The present theory is, that fermentation is caused by the presence of certain micro-organisms, called *bacteria*.

Two Classes into which Ferments are Divided.—Ferments are divided into two classes — organized, or physiological ferments, as yeast, mycoderms, torulas, etc., and unorganized, or chemical ferments, like diastase, synaptase, myrosin, etc.

Vinous Fermentation.—The decomposition of cane sugar into alcohol and carbon dioxide, which occurs when sugar is exposed to the action of water, air, and a warm temperature, and seems to be caused by a microscopic plant, which has been named *Torula cerevisiæ.*

Result of the Action of Dilute Acids and Ferments on Cellulin and Starch.—They are converted into alcohol or acetic acid.

$$\underset{\substack{\text{Cellulin}\\\text{or Starch.}}}{(C_6H_{10}O_5)_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Maltose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Starch.}}{C_6H_{10}O_5};$$

then,

$$\underset{\text{Maltose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Starch.}}{C_6H_{10}O_5} + \underset{\text{Water.}}{2H_2O} = \underset{\text{Glucose.}}{(C_6H_{12}O_6)_3};$$

then,

$$\underset{\text{Glucose.}}{C_6H_{12}O_6} = \underset{\text{Alcohol.}}{(C_2H_5HO)_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{2CO_2}.$$

If the process is not stopped here, the alcohol is oxidized into acetic acid:—

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\text{Oxygen.}}{O_2} = \underset{\text{Acetic Acid.}}{C_2H_4O_2} + \underset{\text{Water.}}{H_2O}.$$

The most important derivative of sugar through the action of a ferment is *alcohol*, usually obtained from whiskey by distillation.

The distilled products of vinous liquors forming the different ardent spirits of commerce are: *brandy*, from wine; *rum*, from fermented molasses; *whiskey*, from cider, malted barley or rye; *Holland gin*, from malted barley and rye meal, with hops, and rectified from juniper berries; *common gin*, from malted barley, rye or potatoes, and rectified from turpentine; *arrack*, from fermented rice.

The compounds derived from sugars may be considered under three heads: 1st. Ethyl hydrate and oxide, and their preparations; 2d. Preparations of the compound ethers of the ethyl and amyl series; 3d. Aldehyd, its derivatives and preparations.

Ethyl Hydrate and Oxide, and their Preparations.

Alcohol is a term used to designate a class of carbon compounds called *alcohols*. Alcohols are hydrates of the radicals *ethyl*, *amyl*, etc., just as calcium hydrate is the hydrate of the metal calcium.

Ethers are the oxides of the radicals, just as the calcium oxide is the oxide of the metal calcium.

Compound ethers are analogous to the salts of metals, just as potassium nitrate, sodium acetate, etc., are compounds of the metals potassium and sodium with the acidulous radicals characterizing nitrates and acetates. They are formed by the decomposition of their alcohols (hydrates) by acids, just as calcium sulphate may be produced by decomposing hydrate of calcium. Water is formed as one of the results of the decomposition.

The following reactions will illustrate the formation of compound ethers:—

$$\underset{\substack{\text{Sodium}\\\text{Hydrate.}}}{NaHO} + \underset{\substack{\text{Acetic}\\\text{Acid.}}}{C_2H_4O_2} = \underset{\substack{\text{Sodium}\\\text{Acetate.}}}{NaC_2H_3O_2} + \underset{\text{Water.}}{H_2O}.$$

$$\underset{\substack{\text{Alcohol, or}\\\text{Ethyl Hydrate.}}}{C_2H_5HO} + \underset{\substack{\text{Acetic}\\\text{Acid.}}}{C_2H_4O_2} = \underset{\text{Ethyl Acetate.}}{C_2H_5C_2H_3O_2} + \underset{\text{Water.}}{H_2O}.$$

SPIRITUS FRUMENTI, U. S.—Whiskey.—An alcoholic liquid, obtained by the distillation of fermented grain (usually corn, wheat or rye), and at least two years old. It has an amber color, a distinctive taste and odor, and a sp. gr. not above 0.930 nor below 0.917, corresponding, approximately, with an alcoholic strength of 44 to 50 per cent., by weight, or 50 to 58 per cent. by volume.

Preparation.—From grain—first, *mashing*, by which the starch is converted into sugar; second, *fermentation*, by which the sugar is converted into alcohol; third, *distillation*, by which the alcohol is separated as crude spirits.

ALCOHOL, U. S.—Alcohol.—A liquid composed of 91 per cent., by weight (94 per cent. by volume), of ethyl alcohol (C_2H_5HO; 46), and 9 per cent., by weight (6 per cent. by volume), of water. Sp. gr. 0.820 at 15.6° C. (60° F.), and 0.812 at 25° C. (77° F.); occurring as a transparent, colorless, mobile and volatile liquid, of a characteristic, pungent and agreeable odor and a burning taste. Boiling at 78° C., and usually obtained by distilling *whiskey*, redistilling and rectifying.

Impurities.—Whiskey is liable to contain *fusel oil*, or *amylic alcohol*, giving it a characteristic odor. It may be deprived of odor by treating it with potassium permanganate, and redistilling.

Absolute Alcohol.—Alcohol entirely free from water. It is prepared by separating the 11 per cent., of water from the strongest alcohol that can be made by distillation, by the use of recently burned lime, out of contact with the air, and redistilling in *vacuo*. Its freedom from water may be tested with anhydrous baryta, or by its forming a clear solution when mixed with an equal bulk of pure benzol.

ALCOHOL DILUTUM, U. S.—Diluted Alcohol.—A liquid composed of 45.5 per cent., by weight (53 per cent. by volume), of ethyl alcohol, and 54.5 per cent., by weight (47 per cent. by volume), of water; sp. gr. 0.928 at 15.6° C. (60° F.), and 0.920, at 25° C. (77° F.). Alcohol, 50 p., or 17 fluidounces; distilled water, 50 p., or 14 fluidounces.

Rule for Preparing Diluted Alcohol from Alcohol of any Higher Percentage—"Divide the alcoholic percentage of the alcohol to be diluted by 45.5 and subtract 1 from the quotient. This gives the number of parts of water to be added to 1 part of the alcohol." All terms denote weight in this rule.

Result if Alcohol and Water are mixed together.—A contraction of volume takes place. (55 gallons of alcohol + 45 gallons of water equals 96¼ gallons—a loss of 3¾ gallons.)

Difference between United States Proof Spirit and Diluted Alcohol.—U. S. *proof spirit* contains 50 per cent., by volume, of absolute alcohol, and has sp. gr. of 0.934; diluted alcohol contains 53 per cent., by volume, of absolute alcohol, and has a specific gravity of 0.928.

ÆTHER, U. S.—Ether.—A liquid composed of about 74 per cent. of ethyl oxide ($C_2H_5)_2O$; 74, and about 26 per cent. of alcohol containing a little water; sp. gr. about 0.750 at 15° C. (59° F.). Made by acting on alcohol with H_2SO_4, between the temperatures of 130° and 137.7° C. (266° and 280° F.). The following reactions occur:—

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Ethyl-sulphuric Acid.}}{C_2H_5HSO_4} + \underset{\text{Water}}{H_2O};$$

then,

$$\underset{\text{Ethyl-sulphuric Acid.}}{C_2H_5HSO_4} + \underset{\text{Alcohol.}}{C_2H_5HO} = \underset{\text{Ether.}}{(C_2H_5)_2O} + \underset{\text{Sulphuric Acid.}}{H_2SO_4}.$$

It will be seen that the sulphuric acid is not consumed in the process, but is regenerated, so that theoretically the making of ether is continuous.

ÆTHER FORTIOR, U. S.—Stronger Ether.— A thin, very diffusive, clear and colorless liquid, composed of about 94 per cent. of ethyl oxide $(C_2H_5)_2O$; 74, and about 6 per cent. of alcohol containing a little water; sp. gr. not higher than 0.725 at 15° C. (59° F.), or 0.716 at 25° C. (77° F.). Made in the same way as ordinary ether, and differing from it only in greater strength and purity.

SPIRITUS ÆTHERIS, U. S.—Spirit of Ether.—Ether 30 p.; Alcohol 70 p.

SPIRITUS ÆTHERIS COMPOSITUS, U. S.—Compound Spirit of Ether. (*Hoffmann's Anodyne.*)—Str. Ether 30 p.; Alcohol 67 p.; ethereal oil 3 p.

Substitute usually sold for Hoffmann's Anodyne.—After the rectification of crude ether, an additional distillate is obtained, consisting of ether and alcohol, impregnated with a little ethereal oil. This is "*doctored*" to conform to the taste, smell, etc., of Hoffmann's Anodyne, and may be detected by mixing it with water, with which it forms a clear solution, instead of the milky solution characterizing the genuine article. *Castor oil* is sometimes added to circumvent this test, which may be detected by mixing equal parts with water, and collecting the separated oil on filtering paper; castor oil leaves a permanent, greasy stain, distinguishing it from ethereal oil.

Preparations of the Compound Ethers of the Ethyl and Amyl Series.

OLEUM ÆTHEREUM, U. S.—Ethereal Oil.—A volatile liquid, consisting of equal volumes of Heavy Oil of Wine and Stronger Ether, occurring as a transparent, nearly colorless, volatile liquid; of a peculiar, aromatic odor; a pungent, refreshing, bitterish taste; and a neutral reaction to dry litmus paper; sp. gr. 0.910. Made by distilling alcohol and sulphuric acid together, at a temperature between 150° and 157° C. (302° and 314.6° F.), until the liquid ceases to come over, or until a black froth begins to rise in the retort; separating the yellow ethereal liquid and exposing it to the air for 24 hours, in a shallow capsule, transferring it to a wet filter, and washing with distilled water and draining, then adding an equal volume of stronger ether.

When alcohol is distilled with a large excess of sulphuric acid, there are produced heavy oil of wine, sulphurous acid, olefiant gas and empyreumatic products. This occurs toward the close of the distillation, and the products generally separate into two layers, one consisting of water holding sulphurous acid in solution, and the other, of ether containing the heavy oil of wine. The heavy oil of wine is obtained by separating it from the other products, exposing for twenty-four hours, to dispel the ether, and washing with water, to free it from all traces of sulphurous acid.

The above refers to the products formed in the latter stages of distillation. In the earlier stage, ethyl-sulphuric acid, $C_2H_5HSO_4$, is formed, which,

during the process, is decomposed, so as to yield ether. But if there is a large excess of sulphuric acid present, the ethyl-sulphuric acid is decomposed, so as to form a small quantity of heavy oil of wine.

Ethereal oil is a mixture of compound ethers—ethyl sulphate, $(C_2H_5)SO_4$, ethyl sulphite, $(C_2H_5)_2SO_4$, with polymeric forms of ethylene, C_2H_4.

SPIRITUS ÆTHERIS NITROSI, U. S.—Spirit of Nitrous Ether. (*Sweet Spirit of Nitre.*)—A clear, mobile, volatile and inflammable liquid, of a pale straw color, inclining slightly to green, and consisting of an alcoholic solution of ethyl nitrite $(C_2H_5.NO_2)$; 75; containing 5 per cent. of the crude ether; fragrant, ethereal odor; free from pungency; sharp, burning taste; sp. gr. 0.823 to 0.825. Prepared by distilling a mixture of alcohol, sulphuric acid and nitric acid together, using a well-cooled condenser, and a receiver surrounded by ice, connected air tight, and further connected with a small vial containing water, into which the connecting-tube dips, the temperature being maintained during the distillation not lower than 80° C. (176° F.) or higher than 82° C. (180° F.), until the reaction ceases. The distillation is then shaken in a flask with ice-cold distilled water, the ethereal layer separated and mixed with nineteen times its weight of alcohol.

In this process, ethyl nitrite is formed, and a compound ether is produced by substituting the acid radicle NO_2 for the hydrogen of the hydroxyl in the alcohol. This is then preserved from decomposition by adding sufficient alcohol.

Reactions for producing ethyl nitrite from alcohol:—

$$\underset{\text{Alcohol.}}{C_2H_6O} + \underset{\text{Nitric Acid.}}{HNO_3} = \underset{\text{Aldehyde.}}{C_2H_4O} + \underset{\text{Nitrous Acid.}}{HNO_2} + \underset{\text{Water.}}{H_2O};$$

then,

$$\underset{\text{Alcohol.}}{C_2H_5(HO)} + \underset{\text{Nitrous Acid.}}{HNO_2} = \underset{\text{Ethyl Nitrite.}}{C_2H_5NO_2} + \underset{\text{Water.}}{H_2O}.$$

Pure Ethyl Nitrite is pale yellow; has the smell of apples; boils at 18° C. (64.4° F.); sp. gr. 0.900.

Sweet spirit of nitre is never entirely free from aldehyd; it is apt to contain a large amount of it if carelessly prepared. Aldehyd readily oxidizes to acetic acid, rendering the preparation sour.

ÆTHER ACETICUS, U. S.—Acetic Ether. $C_2H_5C_2H_3O_2$; 88. (*Acetate of Ethyl.*)—A transparent and colorless liquid, with a strong, fragrant, ethereal and somewhat acetous odor; refreshing taste, and neutral reaction. Prepared by distilling sodium acetate, alcohol and sulphuric acid together, shaking the distillate with exsiccated sodium acetate and re-distilling it. It is a solution of ethyl acetate and a mixture of alcohol and water.

$$\underset{\substack{\text{Sodium}\\\text{Acetate.}}}{NaC_2H_3O_2} + \underset{\substack{\text{Ethyl-sulphuric}\\\text{Acid.}}}{C_2H_5HSO_4} = \underset{\text{Ethyl Acetate.}}{C_2H_5C_2H_3O_2} + \underset{\substack{\text{Acid Sodium}\\\text{Sulphate.}}}{NaHSO_4}.$$

AMYL NITRIS, U. S.—Nitrite of Amyl. $C_5H_{11}NO_2$; 117.—A clear, pale-yellowish liquid; ethereal, fruity odor; aromatic taste; neutral or slightly acid reaction. Prepared by acting on amylic alcohol with nitric acid, by which the latter is deoxidized into nitrous acid, which acts on amylic alcohol as follows:—

$$\underset{\substack{\text{Amylic}\\\text{Alcohol.}}}{C_5H_{11}HO} + \underset{\substack{\text{Nitrous}\\\text{Acid.}}}{HNO_2} = \underset{\substack{\text{Amyl}\\\text{Nitrite.}}}{C_5H_{11}NO_2} + \underset{\text{Water.}}{H_2O}.$$

ALDEHYD, ITS DERIVATIVES AND PREPARATIONS.

Aldehyd is a general term used to define a class of organic bodies. It has a more limited signification, however, as ordinarily used, and applies to ethyl aldehyd, which has a composition C_2H_4O, and is made by depriving alcohol, C_2H_6O, of two hydrogen atoms. This is effected by acting on alcohol with oxidizing agents.

CHLORAL, U. S.—Chloral. C_2HCl_3O,H_2O; 165.2. (*Hydrate of Chloral.*)—Chloral is aldehyd in which three atoms of hydrogen have been replaced by three atoms of chlorine. It occurs in separate, rhomboidal, colorless and transparent crystals, slowly evaporating on exposure to air; aromatic, penetrating and slightly acrid odor; a bitterish, caustic taste; neutral reaction. Prepared by passing dry chlorine gas, in a continuous stream, through absolute alcohol for six or eight weeks.

$$\underset{\text{Alcohol.}}{C_2H_6O} + \underset{\text{Chlorine.}}{2Cl} = \underset{\text{Aldehyd.}}{C_2H_4O} + \underset{\text{Hydrochloric Acid.}}{2HCl};$$

then,

$$\underset{\text{Aldehyd.}}{C_2H_4O} + \underset{\text{Chlorine.}}{6Cl} = \underset{\text{Chloral.}}{C_2HCl_3O} + \underset{\text{Hydrochloric Acid.}}{3HCl}.$$

CHLOROFORMUM VENALE, U. S.—Commercial Chloroform.—A liquid containing at least 98 per cent. of chloroform, obtained by distilling chlorinated lime with alcohol.

$$\underset{\text{Alcohol.}}{C_2H_6O} + \underset{\substack{\text{Calcium}\\\text{Hypochlorite.}}}{CaOCl_2} = \underset{\text{Aldehyd.}}{C_2H_4O} + \underset{\substack{\text{Calcium}\\\text{Chloride.}}}{CaCl_2} + \underset{\text{Water.}}{H_2O};$$

then,

$$\underset{\text{Aldehyd.}}{(C_2H_4O)_2} + 6\underset{\substack{\text{Calcium}\\\text{Hypochlorite.}}}{(CaOCl_2)} = \underset{\text{Chloral.}}{(C_2HCl_3O)_2} + 3\underset{\substack{\text{Calcium}\\\text{Chloride.}}}{CaCl_2} + 3\underset{\substack{\text{Calcium}\\\text{Hydrate.}}}{Ca(HO)_2};$$

then,

$$\underset{\text{Chloral.}}{(C_2HCl_3O)_2} + \underset{\substack{\text{Calcium}\\\text{Hydrate.}}}{Ca(HO)_2} = \underset{\text{Chloroform.}}{(CHCl_3)_2} + \underset{\substack{\text{Calcium}\\\text{Formate.}}}{Ca(CHO_2)_2}.$$

Chloroform can also be produced by substituting three atoms of chlorine for three hydrogen atoms of *methane*, marsh gas, CH_4. It is, therefore, chemically termed *trichlormethane*.

Chloroform may also be produced by acting on chloral hydrate with an alkali.

$$\underset{\text{Chloral Hydrate.}}{C_2HCl_3OH_2O} + \underset{\substack{\text{Potassium}\\\text{Hydrate.}}}{KHO} = \underset{\text{Chloroform.}}{CHCl_3} + \underset{\substack{\text{Potassium}\\\text{Formate.}}}{KCHO_2} + \underset{\text{Water.}}{H_2O}.$$

CHLOROFORMUM PURIFICATUM, U. S.—Purified Chloroform. $CHCl_3$; 119.2.—A heavy, clear, colorless, diffusive liquid; sp. gr. 1.485–1.490; boiling at 60° to 61° C. (140° to 142° F.); corresponding to the presence of three-fourths (¾) to one (1) per cent. of alcohol; characteristic, pleasant, ethereal odor; burning, sweet taste; neutral reaction. Prepared by purifying commercial chloroform with sulphuric acid, carbonate of sodium, alcohol and lime, and distilling.

Rationale of the Operation.—Commercial chloroform contains, as an impurity, a chlorinated pyrogenous oil, which is decomposed by the H_2SO_4,

and, in turn, blackened by it; the chloroform is separated from the H_2SO_4, agitated with solution of Na_2CO_3, to neutralize adhering acid, then mixed with alcohol, to preserve it from decomposition, and redistilled from lime, to separate water.

Spiritus Chloroformi, U. S.—Spirit of Chloroform.

Mistura Chloroformi, U. S.—Chloroform Mixture.

Linimentum Chloroformi, U. S.—Chloroform Liniment.

IODOFORMUM, U. S.—Iodoform. CHI_3; 392.8.—Small, lemon-yellow, lustrous crystals, of the hexagonal system; saffron-like and almost insuppressible odor; unpleasant, slightly sweetish, iodine-like taste; neutral reaction in solution. Made by heating alcohol, acid potassium carbonate and iodine together, with water, and passing chlorine gas through the mixture, to cause the separation of iodoform, which may be filtered out, and purified by washing with distilled water and drying. (Filhol's Process.)

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\text{Iodine.}}{8I} + \underset{\text{Acid Potassium Carbonate.}}{2KHCO_3} =$$

$$\underset{\text{Sodium Iodide.}}{2KI} + \underset{\text{Iodoform.}}{2CHI_3} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon Dioxide.}}{2CO_2}.$$

PRODUCTS OF THE ACTION OF FERMENTS UPON ACID SACCHARINE FRUITS.

Important alcoholic liquids, which have received various names, according to the fruits from which they are derived, are formed by the action of ferment upon acid saccharine fruits.

Wine, from grapes; cider, from apples; perry, from pears, etc., occur by fermenting these fruits.

VINUM ALBUM, U. S.—White Wine.—A pale, amber-colored, or straw-colored, alcoholic liquid. Made by fermenting the unmodified juice of the grape, freed from seeds, stems and skin, and of a sp. gr. of not less than 0.990 nor more than 1.010; of a pleasant odor, free from yeastiness; a full, fruity and agreeable taste; without excessive acidity or sweetness.

White wine should contain not less than 10 per cent. nor more than 12 per cent., by weight, of absolute alcohol.

VINUM RUBRUM, U. S.—Red Wine.—A deep red, alcoholic liquid, made by fermenting the juice of colored grapes in the presence of their skins; of a sp. gr. not less than 0.989 nor more than 1.010; with a pleasant odor, free from yeastiness; a full, fruity, moderately astringent, pleasant taste; without excessive acidity or decided sweetness.

The plant furnishing the grape is called *Vitis vinifera*. The juice of the fruit contains grape sugar, tannin, acid potassium tartrate, calcium tartrate, potassium sulphate, sodium chloride, pectin, albuminous principles and water.

The aroma of wines depends upon the formation of certain compound ethers during the fermentation, and also during the ageing or ripening process.

Difference between Sweet and Dry Wine.—When the quantity of sugar in the juice is large, and the amount of ferment insufficient to convert it all

into alcohol, *sweet* wine is produced. When the quantity of ferment is sufficient to convert all the sugar into alcohol, a strong, or generous, wine is formed. If only a moderate amount of sugar is present, with enough ferment to convert it all into alcohol, the wine is termed dry.

Sparkling Nature and Roughness.—Wine containing carbonic acid gas is called *sparkling;* when the gas is absent it is called *still.* When fermented with the seeds, it becomes rough or astringent, owing to the presence of tannic acid in the seeds.

ARGOLS.—A precipitate of acid potassium tartrate, rendered impure by calcium tartrate, more or less coloring matter and other matters deposited from the juice of the grape during fermentation and clarification. The precipitation is due to the fact that these matters, though soluble in grape juice, are insoluble in the dilute solution of alcohol formed by the fermentation.

SPIRITUS VINI GALLICI, U. S.—Brandy.—An alcoholic liquid obtained by the distillation of fermented grapes, and at least four years old. It should have a pale, amber color, a distinctive taste and odor, and sp. gr. not above 0.941 nor below 0.925, corresponding, approximately, with an alcoholic strength of 39 to 47 per cent., by weight, or 46 to 55 per cent., by volume.

ACIDUM TARTARICUM, U. S.—Tartaric Acid. $H_2C_4H_4O_6$; 150.—Nearly or entirely colorless, transparent, monoclinic prisms, permanent in the air; odorless; purely acid taste; acid reaction. Prepared by saturating the excess of acid in acid potassium tartrate or cream of tartar (prepared from *argols*) with calcium carbonate, and decomposing the resulting insoluble calcium tartrate by sulphuric acid, which precipitates it in combination with the lime, as calcium sulphate, and liberates the tartaric acid. Only one-half the tartaric acid is thus obtained. The remainder may be procured by decomposing the neutral potassium tartrate remaining in the solution after the precipitation of the calcium tartrate, by calcium chloride in excess. This may be decomposed by sulphuric acid, together with the first portion.

$$\underset{\text{Acid Potassium Tartrate.}}{2KHC_4H_4O_6} + \underset{\text{Calcium Carbonate.}}{CaCO_3} =$$

$$\underset{\text{Potassium Tartrate.}}{K_2C_4H_4O_6} + \underset{\text{Calcium Tartrate.}}{CaC_4H_4O_6} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon. Dioxide.}}{CO_2};$$

then,

$$\underset{\text{Potassium Tartrate.}}{K_2C_4H_4O_6} + \underset{\text{Calcium Chloride.}}{CaCl_2} = \underset{\text{Calcium Tartrate.}}{CaC_4H_4O_6} + \underset{\text{Potassium Chloride.}}{2KCl},$$

and

$$\underset{\text{Calcium Tartrate.}}{2CaC_4H_4O_6} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} = \underset{\text{Calcium Sulphate.}}{2CaSO_4} + \underset{\text{Tartaric Acid.}}{2H_2C_4H_4O_6}.$$

Pulvis Effervescens Compositus, U. S.—Compound Effervescent Powder (Seidlitz Powder.)

LIMONIS SUCCUS, U. S.—Lemon Juice.—A yellowish, slightly turbid, acid liquid, having a slight odor of lemon, due to the presence of a trace of the volatile oil of the rind, containing about 7 per cent. of citric

acid, and consisting of the freshly-pressed juice of the ripe fruit of *Citrus limonum*.

Syrupus Limonis, U. S.—Syrup of Lemon.

Mistura Potassii Citratis, U. S.—Mixture of Citrate of Potassium.

ACIDUM CITRICUM, U. S.—**Citric Acid.** $H_3C_6H_5O_7.H_2O$; 210.—Colorless, right rhombic prisms, not deliquescent except in moist air; efflorescent in warm air; odorless; agreeable, acid taste; acid reaction. Obtained from the juice of limes and lemons, by saturating the boiling juice with calcium carbonate, and decomposing the resulting calcium citrate with sulphuric acid, concentrating and crystallizing.

$$\underset{\text{Citric Acid in Lemon Juice.}}{2H_3C_6H_5O_7} + \underset{\text{Calcium Carbonate.}}{3CaCO_3} = \underset{\text{Calcium Citrate.}}{Ca_32C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon Dioxide.}}{3CO_2};$$

then,

$$\underset{\text{Calcium Citrate.}}{Ca_32C_6H_5O_7} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} = \underset{\text{Citric Acid.}}{2H_3C_6H_5O_7} + \underset{\text{Calcium Sulphate.}}{3CaSO_4}.$$

Syrupus Acidi Citrici, U. S.—Syrup of Citric Acid.

TAMARINDUS, U. S.—**Tamarind.**—The preserved pulp of the fruit of *Tamarindus indica*, containing citric and tartaric acids and small quantities of malic acid. Used in preparing confection of senna.

RHUS GLABRA, U. S.—**Rhus Glabra.** (*Rhus Glabrum, Pharm. 1870. Sumach.*)—The fruit of *Rhus glabra*, containing malic acid, which exists in it as calcium and potassium malate.

Extractum Rhois Glabræ Fluidum, U. S.—Fluid Extract of Rhus Glabra.

Acid Saccharine Fruits Containing Pectinous Bodies.

PECTIN.—A peculiar principle existing in certain fruits, and formed by the action of two other principles, *pectase* and *pectose*, upon each other during the process of ripening.

The moderate action of heat and water upon the fruits causes the citric, tartaric or malic acid therein contained to act on the pectose, softening it and converting it into pectin. The pectin is then acted upon by the ferment *pectase*, which causes it to gelatinize on cooling, through the production of pectosic acid. This explains the formation of fruit jellies.

Syrupus Rubi Idæi, U. S.—Syrup of Raspberry.

VOLATILE OILS.

Volatile or *essential* oils are odorous principles found in various parts of plants, pre-existing, or produced by the reaction of certain constituents when brought in contact with water; or sometimes formed through destructive distillation, as the oil of amber; or they may be obtained from the animal kingdom, as the oil from ambergris.

Four Classes into which Volatile Oils may be Divided.—1st. Terpenes, or hydrocarbons, consisting of C and H, mostly with the formula $C_{10}H_{16}$; type, oil of turpentine. 2d. Oxygenated oils, or hydrocarbons containing oxygen; type, oil of cinnamon. 3d. Sulphurated oils, containing sulphur;

type, volatile oil of mustard. 4th. Nitrogenated oils, a small class, containing hydrocyanic acid; type, oil of bitter almond.

Two Proximate Principles of which Volatile Oils Consist.—*Stearopten* and *eleopten*, the former congealing at a lower temperature than the latter. Some of the stearoptens are called camphors.

Action of Light and Air on Volatile Oils.—The fragrance of the oil is destroyed, *ozone* is developed and the oils thicken, resinify or deposit crystalline compounds.

Actions of Acids and Alkalies on Volatile Oils.—Strong nitric acid decomposes them with great rapidity; some oils react with iodine with explosive violence. Alkalies, with the exception of a few oils with which they form chemical compounds, have, generally, but little effect on volatile oils.

Principal Adulterations.—*Fixed oil;* detected by dropping the suspected oil on a piece of filtering paper; if a fixed oil is present, the stain will not evaporate on gently heating. *Alcohol;* detected by shaking in a graduated tube, with glycerine or water, which takes up the alcohol and decreases the volume of oil. Or if a large quantity of alcohol has been used, by setting fire to a small portion in a dish in a dark room, when the lambent blue flame of burning alcohol will be seen, in contrast to the yellow, sooty flame of volatile oil. Other tests are metallic sodium, calcium chloride and aniline red. *Volatile oils, or cheaper grades* of the *same* oil, or a *cheaper oil having a similar odor;* test, by the olfactories.

Preparation.—Volatile oils are usually prepared from plants, and generally, either by distillation with water, distillation *per se*, expression or solution.

1. *Distillation with Water.*—Put the substance from which the oil is to be extracted into a still, and add enough water to cover it; then distill, by a regulated heat, into a large refrigeratory. Separate the distilled oil from the water which comes over with it.

2. *Distillation per se.*—Distillation "by itself," or without the use of water. Ex.—Certain oleoresins, copaiba, etc.

3. *Expression.*—The volatile oil of orange will illustrate this process. The advantage is, that heat is not employed; but the disadvantage is, that expressed oils have a small portion of albumen, which renders them turbid.

4. *Solution or Absorption.*—This operation is effected by maceration, digestion, percolation with carbon bisulphide or similar solvent, enfleurage, or the pneumatic process. Used in cases where the oils are so delicate that they are decomposed by distillation, and exist in such small proportion in the plant that it does not pay to express them.

Maceration.—This is accomplished by allowing the odorous portion of a plant to stand in contact with a bland, inodorous, fixed oil. The oil absorbs the odor, and, after a certain length of time, it is strained. The odorous fixed oil is generally used in perfumes.

Digestion.—Similar to maceration, except moderate heat is employed.

Enfleurage.—A cold process, and much used for delicate flowers; conducted by sprinkling the flowers on thin layers of purified, inodorous fat spread on glass. The glasses are fixed in frames resembling window-sashes. The frames are piled in a stack, and left undisturbed for twelve hours or three or four days.

When strong pomade is desired, fresh flowers are added from time to time, as long as absorption continues, and the pomades are known commercially as Nos. 6, 12, 18 and 24, which indicate their strength. When the volatile oils are desired, they are extracted from the pomade by macerating the latter, in a finely chopped condition, in pure alcohol; afterward separating the small amount of fatty matter dissolved by the alcohol, by refrigerating and filtering.

Pneumatic Process.—Used only with very delicate volatile oils. It consists in forcing a current of air through a vessel filled with fresh flowers, into another vessel containing melted purified fat, with revolving circular plates half immersed therein. These circular plates become coated with fat, and absorb the odor from the perfumed air.

Percolation.—Odorous flowers are percolated with purified carbon disulphide. The latter is distilled, thus separating it from the volatile oil.

Officinal Products from the Aurantiaceæ.

AURANTII DULCIS CORTEX, U. S.—Sweet Orange Peel.—The rind of the fruit of *Citrus aurantium* owes its virtues to the volatile oil found in the epidermis. It also communicates a yellowish color to the preparations made with it.

Syrupus Aurantii, U. S.—Syrup of Orange.

Tinctura Aurantii Dulcis, U. S.—Tincture of Sweet Orange Peel.

AURANTII AMARI CORTEX, U. S.—Bitter Orange Peel.—The rind of the fruit of *Citrus vulgaris* contains *hesperidin* and a small quantity of volatile oil.

Extractum Aurantii Amari Fluidum, U. S.—Fluid Extract of Bitter Orange Peel.

Tinctura Aurantii Amari, U. S.—Tincture of Bitter Orange Peel.

OLEUM AURANTII CORTICIS, U. S.—Oil of Orange Peel.—The volatile oil extracted, by mechanical means, from fresh orange peel is of a pale yellowish color, and has the composition of the terpenes, $C_{10}H_{16}$. Its sp. gr. is 0.860. Soluble in alcohol, and may be preserved by shaking it with one-fourth of its volume of water, separating and mixing with five times its measure of alcohol. Very prone to decomposition and rapidly acquires a terebinthinate odor. Used in making cologne water and bay rum and to flavor elixirs.

Elixir Aurantii, U. S.—Elixir of Orange.

Spiritus Aurantii, U. S.—Spirit of Orange.

AURANTII FLORES, U. S.—Orange Flowers.—The partly-expanded, fresh flowers of *Citrus vulgaris* and *Citrus aurantium*.

Aqua Aurantii Florum, U. S.—Orange Flower Water. Made by distilling 100 parts of water from 40 parts of recent orange flowers.

OLEUM AURANTII FLORUM.—Oil of Orange Flowers. (*Oil of Neroli.*)—The volatile oil, distilled from fresh orange flowers, is a brownish-yellow, very fragrant terpene ($C_{10}H_{16}$); sp. gr. 0.850 to 0.890; soluble in an equal weight of alcohol, and is well preserved by this addition. An inferior sort, *essence de petit grain*, is made by distilling the leaves and unripe fruit.

LIMONIS CORTEX, U. S.—Lemon Peel.—The rind of the recent fruit of *Citrus limonum* contains volatile oil and *hesperidin*.

OLEUM LIMONIS, U. S.—Oil of Lemon.—The volatile oil, extracted, by mechanical means, from fresh lemon peel, is a terpene, $C_{10}H_{18}$. When fresh, it has the fragrant odor of lemons; sp. gr. 0.850.

Spiritus Limonis, U. S.—Spirit of Lemon.

OLEUM BERGAMII, U. S.—Oil of Bergamot.—The volatile oil extracted, by mechanical means, from the rind of the fresh fruit of *Citrus bergamia*, var. *vulgaris*, is a terpene ($C_{10}H_{16}$); sp. gr. from 0.860 to 0.890; soluble, in all proportions, in alcohol and glacial acetic acid. This oil is usually prepared by expression, in the same manner as the oils of lemon and orange peel.

Officinal Products from the Labiatæ.

MENTHA PIPERITA, U. S.—Peppermint.—The leaves and tops of *Mentha piperita* contain about 2 per cent. of volatile oil.

OLEUM MENTHÆ PIPERITÆ, U. S.—Oil of Peppermint.—The volatile oil distilled from peppermint is a colorless or yellowish liquid, having the characteristic, strong odor of peppermint, a strongly aromatic taste, followed by a sensation of cold air when drawn into the mouth, and a neutral reaction; sp. gr. about 0.900. It is soluble in an equal weight of alcohol.

Menthol.—The oil of peppermint owes its odor to *menthol* ($C_{10}H_{20}O$), a stearopten obtained from it through fractional distillation, cooling and crystallization. The crystals are beautiful, colorless needles, melting at 42° C. (176° F.), boiling at 212° C. (414° F.); insoluble in water, but soluble in alcohol, ether, chloroform and benzin. It is largely used, compressed into cones, as a remedy in neuralgia and headache. A portion of the oil has the composition $C_{10}H_{18}O$.

Aqua Menthæ Piperitæ, U. S.—Peppermint Water.

Spiritus Menthæ Piperitæ, U. S.—Spirit of Peppermint.

Trochisci Menthæ Piperitæ, U. S.—Troches of Peppermint.

MENTHA VIRIDIS, U. S.—Spearmint.—The leaves and tops of *Mentha viridis* contain from ½ to 1 per cent. of volatile oil.

OLEUM MENTHÆ VIRIDIS, U. S.—Oil of Spearmint.—The volatile oil distilled from spearmint is a colorless or yellowish liquid, having the characteristic, strong odor of spearmint, a hot, aromatic taste and a neutral reaction; sp. gr. about 0.900. It is soluble in an equal weight of alcohol, and contains an oxygenated oil, $C_{10}H_{14}O$, which is the odorous portion, and a terpene, $C_{10}H_{16}$.

Aqua Menthæ Viridis, U. S.—Spearmint Water.

Spiritus Menthæ Viridis, U. S.—Spirit of Spearmint.

LAVANDULA, U. S.—Lavender.—The flowers of *Lavandula vera* contain a volatile oil.

OLEUM LAVANDULÆ, U. S.—Oil of Lavender.—The volatile oil distilled from the flowering tops, or the whole herb, of *Lavandula vera* is a colorless or yellowish liquid, having the aromatic odor of lavender, a pungent and bitterish taste, and a neutral reaction while fresh; sp. gr. about 0.890. $C_{10}H_{16}$, and compound ethers of $C_{10}H_{16}O$ and $C_{10}H_{18}O$.

Tinctura Lavandulæ Composita, U. S.—Compound Tincture of Lavender.

OLEUM LAVANDULÆ FLORUM, U. S.—**Oil of Lavender Flowers.**—The volatile oil distilled from fresh lavender is a colorless or yellowish liquid, having the fragrant odor of lavender flowers, a pungent and bitterish taste, and a neutral reaction while fresh; sp. gr. about 0.890.

Spiritus Lavandulæ, U. S.—Spirit of Lavender.

ROSMARINUS, U. S.—Rosemary.—The leaves of *Rosmarinus officinalis* contain a fragrant, volatile oil.

OLEUM ROSMARINI, U. S.—Oil of Rosemary.—The volatile oil distilled from rosemary is a colorless or yellowish liquid, having the characteristic, pungent odor of rosemary; a warm, somewhat camphoraceous taste, and a neutral or faintly acid reaction; sp. gr. about 0.900. It consists of a terpene, $C_{10}H_{16}$, and the oxygenated compounds $C_{10}H_{16}O$, $C_{10}H_{18}O$.

HEDEOMA, U. S. — Hedeoma. (*Pennyroyal.*) — The leaves and tops of *Hedeoma pulegioides*, and is frequently confounded with Mentha pulegium, or European pennyroyal, which yields an oil having a similar odor and properties.

OLEUM HEDEOMÆ, U. S. — Oil of Hedeoma. (*Oil of Pennyroyal.*)—The volatile oil distilled from Hedeoma is a colorless or yellowish liquid, of a pungent, mint-like odor and taste and a neutral reaction; sp. gr. about 0.940.

This is an oxygenated oil.

MARRUBIUM, U. S.—Marrubium. (*Horehound.*)—The leaves and tops of *Marrubium vulgare* contain a volatile oil associated with resin, and a bitter principle, *Marrubiin*.

MELISSA, U. S.—Melissa. (*Balm.*)—The leaves and tops of *Melissa officinalis* contain an oxygenated volatile oil.

ORIGANUM, U. S.—Origanum. (*Wild Marjoram.*)—*Origanum vulgare* contains an oxygenated volatile oil in very small quantity. *This is not the plant which yields the commercial oil of origanum.* (See Oleum Thymi.)

OLEUM THYMI, U. S.—Oil of Thyme.—The volatile oil distilled from *Thymus vulgaris* is a colorless or pale yellow, thin liquid, having a strong odor of thyme, a warm, pungent, and, afterwards, cooling taste, and a neutral reaction; sp. gr. about 0.880. The oil, as prepared in the south of France, is known commercially as *oil of origanum*.

SALVIA, U. S.—Salvia. (*Sage.*)—The leaves of *Salvia officinalis* contain a volatile oil, which consists of a terpene, $C_{10}H_{16}$, and an oxygenated portion, *salviol*, $C_{10}H_{18}O$.

SCUTELLARIA, U. S. — Scutellaria. (*Scullcap*). — *Scutellaria lateriflora* contains volatile oil, tannin and a bitter principle.

Extractum Scutellariæ Fluidum, U. S.—Fluid Extract of Scutellaria.

Officinal Products of the Aromatic Umbelliferæ.

CARUM, U. S.—Caraway.—The fruit of *Carum carvi* contains about 5 per cent. of volatile oil, with a little fixed oil and other constituents.

OLEUM CARI, U. S.—Oil of Caraway.—The volatile oil distilled from caraway is a pale-yellow liquid, having the odor of caraway, and a sp. gr. of about 0.920. It consists of a terpene, *carvene*, $C_{10}H_{16}$, and *carvol*, $C_{10}H_{14}$.

FŒNICULUM, U. S.—Fennel.—The fruit of *Fœniculum vulgare* contains about 5 per cent. of an oxygenated volatile oil, with 10 per cent. of fixed oil.

OLEUM FŒNICULI, U. S.—Oil of Fennel.—A volatile oil distilled from fennel; a pale-yellow liquid, having the odor of fennel, and a sp. gr. of not less than 0.960. Consisting of a terpene, $C_{10}H_{16}$, and anethol, $C_{10}H_{12}O$.

Aqua Fœniculi, U. S.—Fennel Water.

CORIANDRUM, U. S.—Coriander.—The fruit of *Coriandrum sativum* furnishes about 1 per cent. of an agreeable, aromatic oil, also about 10 per cent. of fixed oil.

OLEUM CORIANDRI, U. S.—Oil of Coriander.—A volatile oil distilled from Coriander.

A colorless or yellowish liquid, having the characteristic aromatic odor of coriander, a warm, spicy taste, and a neutral reaction; sp. gr. about 0.870; composed, principally, of $C_{10}H_{18}O$.

SUMBUL, U. S.—Sumbul.—The root of *Ferula Sumbul* contains about ½ per cent. of volatile oil and about 10 per cent. of a resinous compound having a musky odor.

Tinctura Sumbul, U. S.—Tincture of Sumbul.

ANISUM, U. S.—Anise.—The fruit of *Pimpinella anisum* contains about 2 per cent. of volatile oil and 3 per cent. of fixed oil.

OLEUM ANISI, U. S.—Oil of Anise.—A volatile oil distilled from anise or from illicium; colorless or yellowish, with the peculiar odor and taste of the fruit; sp. gr. about 0.976 to 0.990, increasing with age. At 10° to 15° C. (50° to 59° F.) it solidifies to a crystalline mass, which does not resume its fluidity until the temperature rises to about 17° C. (62.6° F.). *Oil of Illicium* (*Star-anise*) has nearly the same properties, except that it congeals at about 2° C. (35.6° F.). It consists of a small quantity of hydrocarbon, $C_{10}H_{16}$, but mainly of *anethol*, $C_{10}H_{12}O$, which is present in two modifications—one solid at ordinary temperatures and heavier than water (*anise camphor*, *solid anethol*), the other liquid and more volatile (*liquid anethol*). *Anethol*, both in the liquid and in the solid form, is present, and is the chief constituent of the oils of *anise*, *star-aniseed* and *fennel*.

Aqua Anisi, U. S.—Anise Water.

Spiritus Anisi, U. S.—Spirit of Anise.

ILLICIUM, U. S.—Star-Anise.—The fruit of *Illicium anisatum* is the source of nearly all the commercial oil of anise.

Officinal Aromatic Products, with their Volatile Oils.

CINNAMOMUM, U. S.—Cinnamon.—The inner bark of the shoots of *Cinnamomum zeylanicum* (Ceylon cinnamon), or the bark of the shoots of one or more undetermined species of *Cinnamomum* grown in China (Chinese cinnamon, or *Cassia*).

Tinctura Cinnamomi, U. S.—Tincture of Cinnamon.

OLEUM CINNAMOMI, U. S.—Oil of Cinnamon.—A volatile oil distilled from cinnamon.

There is no essential difference between the oil of Ceylon cinnamon and

oil of cassia, except the latter is much the cheaper and more abundant of the two.

Oil of Ceylon Cinnamon has a slightly acid reaction; sp. gr. about 1.040. When cooled to —10° C. (14° F.), it remains clear, but at a lower temperature a solid portion separates from it. *Oil of Chinese Cinnamon* (Oil of Cassia) has the same properties, except that its specific gravity is about 1.060, and its odor and taste are not quite so agreeable.

Oil of cinnamon consists of *cinnamic aldehyd*, C_9H_8O, which, by moderate oxidation, yields the corresponding cinnamic acid, $C_9H_8O_2$, but, by more energetic oxidation, yields benzoic acid, $C_7H_6O_2$.

Oil of Ceylon cinnamon when it is not very fresh contains cinnamic acid in sufficient quantity to give a permanent cloudiness to cinnamon water made from it.

Aqua Cinnamomi, U. S.—Cinnamon Water.

Spiritus Cinnamomi, U. S.—Spirit of Cinnamon.

CARYOPHYLLUS, U. S.—Cloves.—The unexpanded flowers of *Eugenia caryophyllata* contain about 16 per cent. of volatile oil, 10 per cent. of tannin, *caryophyllin*, $C_{10}H_{16}O$, a crystalline principle, and *eugenin*, $C_{10}H_{12}O_2$, also crystalline.

OLEUM CARYOPHYLLI, U. S.—Oil of Cloves.—A volatile oil distilled from cloves. When recently distilled, a very fluid, clear and colorless liquid, but becomes yellowish by exposure, and ultimately reddish-brown. It has the odor of cloves, a hot, acrid, aromatic taste, and a slightly acid reaction; its sp. gr. is about 1.050. It consists of two distinct oils, one lighter (a terpene), and the other heavier, than water. *Light oil of cloves* is colorless, is of the sp. gr 0.918, and has the formula $C_{10}H_{16}$. *Heavy oil of cloves* is colorless at first, but darkens with age; has the odor and taste of cloves; is of the sp. gr. 1.079; boils at 243.3° C. (470° F.), and forms soluble and crystallizable salts with the alkalies. It consists of a phenol-like compound, *eugenol* (eugenic acid), $C_{10}H_{12}O_2$, which has been found capable of conversion into *vanillin*.

PIMENTA, U. S.—Pimenta. (*Allspice.*)—The nearly ripe fruit of *Eugenia pimenta* contains about 3 per cent. of volatile oil, with tannin, fat, resin, gum, sugar, etc.

OLEUM PIMENTA, U. S.—Oil of Pimenta. (*Oil of Allspice.*)—A volatile oil distilled from pimenta. A colorless or pale-yellow liquid becoming darker and thicker by age and exposure to air; having a strong, aromatic, clove-like odor; a pungent, spicy taste, and a slightly acid reaction; sp. gr. about 1.040. It contains a terpene, $C_{10}H_{16}$, and eugenol, $C_{10}H_{12}O_2$.

OLEUM MYRCIÆ, U. S.—Oil of Myrcia. (*Oil of Bay.*)—A volatile oil distilled from the leaves of *Myrcia acris*. A brownish or dark-brown liquid; of an aromatic, somewhat clove like odor; a pungent, spicy taste, and a slightly acid reaction; sp. gr. about 1.040. It consists of two portions—a terpene, $C_{10}H_{16}$, and eugenol $C_{10}H_{12}O_2$.

Spiritus Myrciæ, U. S.—Spirit of Myrcia (Bay Rum).

VANILLA, U. S.—Vanilla.—The fruit of *Vanilla planifolia* contains a trace of a volatile oil, 10 per cent. of fixed oil, resin, sugar, etc., and *vanillin*, $C_8H_8O_3$.

Tinctura Vanillæ, U. S.—Tincture of Vanilla.

OLEUM CAJUPUTI, U. S.—Oil of Cajuput.—A volatile oil distilled from the leaves of *Melaleuca cajuputi*. Very fluid, transparent; of a green color; a penetrating odor, analogous to that of cardamom, and a warm, pungent taste. Composition is $C_{10}H_{16}.H_2O$. It is termed, chemically, *cajuputene hydrate*, or *cajuputol*, Sp. gr. about 0.920.

EUCALYPTUS, U. S.—Eucalyptus.—The leaves of *Eucalyptus globulus*, collected from rather old trees, contain a volatile oil, resin, tannin, chlorophyl, fatty acid, etc.

Extractum Eucalypti Fluidum, U. S.—Fluid Extract of Eucalyptus.

OLEUM EUCALYPTI, U. S.—Oil of Eucalyptus.—A volatile oil distilled from the fresh leaves of *Eucalyptus globulus*, or *Eucalyptus amygdalina* Labillardière, and some other species of *Eucalyptus*. A colorless or very pale-yellowish liquid, having a characteristic aromatic odor, a pungent, spicy and cooling taste, and a neutral reaction; sp. gr. about 0.900. The larger portion of the oil consists of *eucalyptol*, $C_{10}H_{16}O$, which is very soluble in alcohol; there are also present two terpenes, $C_{10}H_{14}$,$C_{10}H_{16}$.

MYRISTICA, U. S.—Nutmeg.—The kernel of the seed of *Myristica fragrans*, deprived of its testa, owes its activity to the presence of an oxygenated volatile oil.

OLEUM MYRISTICÆ, U. S.—Oil of Nutmeg.—A volatile oil distilled from nutmeg. A colorless or yellowish liquid having the characteristic odor of nutmeg, a hot, spicy taste, and a neutral reaction; sp. gr. 0.930.

It consists of a terpene, called myristicene, $C_{10}H_{16}$, and an oxygenated portion, $C_{10}H_{14}O$, myristicol.

Expressed oil of nutmeg, or *oil of mace*, is a fixed oil, made by expressing nutmegs between hot plates, or macerating them in carbon disulphide and distilling.

Spiritus Myristicæ, U. S.—Spirit of Nutmeg.

MACIS, U. S.—Mace.—The arillus of the fruit of *Myristica fragrans* contains about 70 per cent. of a light, volatile oil, chiefly a terpene, $C_{10}H_{16}$ (macene), and a fixed oil.

CASCARILLA, U. S.—Cascarilla.—The bark of *Croton eluteria* Bennett contains about 2 per cent. of an oxygenated volatile oil, a crystalline principle, *cascarillin*, $C_{12}H_{18}O_4$, 15 per cent. of resin, also tannin, gum, pectin, etc.

SASSAFRAS, U. S.—Sassafras.—The bark of the root of *Sassafras officinalis* contains volatile oil, sassafrid, tannin, starch, resin, etc.

OLEUM SASSAFRAS, U. S.—Oil of Sassafras.—A volatile oil distilled from sassafras. A colorless or yellowish liquid, becoming darker and somewhat thicker by age and exposure to air; having the characteristic odor of sassafras, a warm, aromatic taste, and a neutral reaction; sp. gr. about 1.090.

GAULTHERIA, U. S.—Gaultheria. (*Wintergreen.*)—The leaves of *Gaultheria procumbens* contain a heavy, volatile oil, ericolin, arbutin, ursol, tannin, gum, sugar, etc.

OLEUM GAULTHERIÆ, U. S.—Oil of Gaultheria. (*Oil of Wintergreen.*)—A volatile oil distilled from gaultheria, consisting of a terpene, $C_{10}H_{16}$, termed *gaultherilene*, and methyl salicylate, $CH_3,C_7H_5O_3$.

It is the heaviest of all the volatile oils, having the sp. gr. 1.180. It is a colorless or yellow or reddish liquid, of a peculiar, strong and aromatic odor; a sweetish, warm and aromatic taste, and a slightly acid reaction; sp. gr. about 1.180. The reddish color is due to a trace of iron.

Spiritus Gaultheriæ, U. S.—Spirit of Gaultheria.

CALAMUS, U. S.—Calamus. (*Sweet Flag.*)—The rhizome of *Acorus calamus* contains a volatile oil, having the composition of a terpene, $C_{10}H_{16}$, soft resin, a bitter principle, acorin, starch and mucilage.

Extractum Calami Fluidum, U. S.—Fluid Extract of Calamus.

CARDAMOMUM, U. S.—Cardamom.—The fruit of *Elettaria cardamomum* contains 5 per cent. of an oxygenated volatile oil, of the sp. gr. 0.943, 10 per cent. of fixed oil, starch, mucilage, etc.

Tinctura Cardamomi, U. S.—Tincture of Cardamom.

Tinctura Cardamomi Composita, U. S.—Compound Tincture of Cardamom.

ZINGIBER, U. S.—Ginger.—The rhizome of *Zingiber officinale* owes its virtues to about 4 per cent. of volatile oil (terpene), having the composition $C_{10}H_{16}$, and a soft, pungent, aromatic resin, which is soluble in alcohol and ether.

Extractum Zingiberis Fluidum, U. S.—Fluid Extract of Ginger.

Oleoresina Zingiberis, U. S.—Oleoresin of Ginger.

Syrupus Zingiberis, U. S.—Syrup of Ginger.

Tinctura Zingiberis, U. S.—Tincture of Ginger.

Trochisci Zingiberis, U. S.—Troches of Ginger.

Stearoptens from Volatile Oils.

CAMPHORA, U. S.—Camphor. $C_{10}H_{16}O$; 152.—A stearopten derived from *Cinnamomum camphora*, and purified by sublimation. It occurs in white, translucent massess, of a tough consistence and crystalline structure; readily pulverizable in the presence of a little alcohol, ether or chloroform.

CAMPHORA MONOBROMATA, U.S.—Monobromated Camphor. $C_{10}H_{15}BrO$; 230.8.—Colorless, prismatic needles or scales, permanent in the air, and unaffected by light; mild, camphoraceous odor; mild, camphoraceous taste; neutral reaction. Made by heating camphor and bromine together, cooling, dissolving the crystalline mass in petroleum benzine, and recrystallizing.

THYMOL, U. S.—Thymol. $C_{10}H_{13}HO$; 150.—Large crystals of the hexagonal system; nearly or quite colorless. It liquefies like camphor; aromatic, thyme-like odor; pungent, aromatic taste, with a very slight caustic effect upon the lips; neutral reaction. Made by the fractional-distillation of the volatile oils of several plants, by which terpenes are separated. The portion distilling above 190° C. (374° F.) is collected, agitated with solution of soda, to separate more of the terpenes, and cooled; the compound of thymol with soda is then decomposed with HCl.

Officinal Substances Containing Nitrogenated and Sulphurated Oils, with Allied Products.

AMYGDALA AMARA, U. S.—Bitter Almond.—The seed of *Amygdalus communis*, var. *amara*, containing a glucoside called *amygdalin*,

which splits into benzyl-aldehyd, or oil of bitter almond, hydrocyanic acid and glucose, under the influence of emulsin, or synaptase, a ferment, which becomes active in the presence of water.

$$\underset{\text{Crystallized Amygdalin.}}{C_{20}H_{27}NO_{11}} + \underset{\text{Water.}}{3H_2O} =$$

$$\underset{\text{Dextro-glucose.}}{2(C_6H_{12}O_6)} + \underset{\text{Hydrocyanic Acid.}}{HCN} + \underset{\text{Oil of Bitter Almond.}}{C_7H_6O} + \underset{\text{Water.}}{H_2O.}$$

OLEUM AMYGDALÆ AMARÆ, U. S.—**Oil of Bitter Almonds**—A colorless or yellowish, thin, volatile oil, with a peculiar, aromatic odor; bitter and burning taste; neutral reaction. Obtained from bitter almond by maceration with water and subsequent distillation.

Preparation.—The bitter almond cake obtained after extracting the fixed oil is mixed with water, and distilled by passing a current of steam through it. The emulsin reacts on the amygdalin in presence of the aqueous vapor, and oil of bitter almond, or benzyl-aldehyd, is produced.

$$\underset{\text{Amygdalin.}}{C_{20}H_{27}NO_{11}} + \underset{\text{Water.}}{2H_2O} = \underset{\text{Benzyl-aldehyd.}}{C_7H_6O} + \underset{\text{Glucose.}}{2C_6H_{12}O_6} + \underset{\text{Hydrocyanic Acid.}}{HCN.}$$

As sweet almond does not contain amygdalin, oil of bitter almond cannot be prepared from it.

Artificial benzyl-aldehyd is made by the action of chlorine upon hot toluol, C_7H_8. Benzyl-chloride, $C_6H_5CH_2Cl$, results, and this yields benzyl-aldehyd on distillation with lead nitrate and water, in an atmosphere of CO_2. It is identical with oil of bitter almond.

Oil of Myrbane, or nitro-benzol, is an entirely different product, made by reacting on benzol with nitric acid. Its odor is similar to, but not identical with, oil of bitter almond. It is used for perfuming soaps.

Aqua Amygdalæ Amaræ, U. S.—Bitter Almond Water.

PRUNUS VIRGINIANA, U. S.—**Wild Cherry.**—The bark of *Prunus serotina*, collected in autumn, contains amygdalin, emulsin, tannin, bitter principle, starch, etc., and furnishes the same reaction with water with the production of oil of bitter almond and hydrocyanic acid as bitter almond.

Infusum Pruni Virginianæ, U. S.—Infusion of Wild Cherry.

Syrupus Pruni Virginianæ, U. S.—Syrup of Wild Cherry.

Extractum Pruni Virginianæ Fluidum, U. S.—Fluid Extract of Wild Cherry.

ACIDUM HYDROCYANICUM DILUTUM, U. S.—**Diluted Hydrocyanic Acid.** (*Prussic Acid.*)—A colorless liquid, of a characteristic odor and taste, resembling bitter almonds; slight acid reaction; composed of 2 per cent. absolute hydrocyanic acid (HCN; 27) and 98 per cent. of alcohol and water. Made by distilling together potassium ferrocyanide, diluted alcohol and sulphuric acid, and diluting to the proper strength with distilled water.

$$\underset{\text{Potassium Ferrocyanide.}}{(K_4FeCy_6)_2} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} =$$

$$\underset{\substack{\text{Potassium Ferrous Ferrocyanide.} \\ \text{(Everitt's Salt.)}}}{K_2Fe_2Cy_6} + \underset{\substack{\text{Potassium} \\ \text{Acid Sulphate.}}}{(KHSO_4)_2} + \underset{\substack{\text{Hydrocyanic} \\ \text{Acid.}}}{6HCy.}$$

Scheele's Hydrocyanic Acid is a stronger solution, containing about 5 per cent. anhydrous acid.

SINAPIS ALBA, U. S.—White Mustard.—The seed of *Sinapis alba* Linné "contains *sinalbin*, $C_{30}H_{44}N_2O_{16}S_2$, a crystalline glucoside, which, under the influence of a peculiar ferment, *myrosin*, and water, is split into *acrinyl thiocyanate*, C_8H_7NOS, which is a pungent, volatile oil (this is not the officinal oil of mustard), *sinapine sulphate*, $C_{16}H_{23}NO_5 \cdot H_2SO_4$, and glucose. The seed contains, in addition, 20 per cent. of fixed oil, mucilage, gum, etc., but no starch." (Remington.)

SINAPIS NIGRA, U. S.—Black Mustard.—The seed of *Sinapis nigra* "contains potassium myronate ($KC_{10}H_{18}NS_2O_{10}$), *myrosin*, a ferment, 25 per cent. of fixed oil, mucilage, etc. Under the influence of the myrosin and water, the potassium myronate is converted into allyl isothiocyanate, or volatile oil of mustard. This action takes place at ordinary temperatures, and explains the pungency of aqueous mixtures of ground mustard." (Remington.)

Charta Sinapis, U. S.—Mustard Paper.

OLEUM SINAPIS VOLATILE, U. S.—Volatile Oil of Mustard.—A volatile oil obtained from black mustard by maceration with water, and subsequent distillation.

Chemically, this oil is *allyl iso-thiocyanate*; it is also called *sulphocyanide of allyl*. It is prepared artificially by distilling *allyl sulphate* with *potassium thiocyanate*. It is a colorless or pale yellow liquid, having a very pungent and acrid odor and taste, and a neutral reaction; sp. gr. 1.017 to 1.021.

Linimentum Sinapis Compositum, U.S.—Compound Liniment of Mustard.

ALLIUM, U. S.—Garlic.—The bulb of *Allium sativum* contains a volatile sulphurated oil known as allyl sulphide $(C_3H_5)_2S$, mucilage, albumen, etc.

Syrupus Allii, U. S.—Syrup of Garlic.

OFFICINAL DRUGS AND PRODUCTS CONTAINING VOLATILE OIL WITH SOFT RESIN.

PIPER, U. S.—Pepper. (*Black Pepper.*)—The unripe fruit of *Piper nigrum* contains piperine, a feeble alkaloid, 2 per cent. volatile oil (a terpene, $C_{10}H_{16}$), a pungent resin.

Oleoresinæ Piperis, U. S.—Oleoresin of Pepper.

PIPERINA, U. S.—Piperine. $C_{17}H_{19}NO_3$; 285.—A proximate principle, of feebly alkaloidal power, prepared from pepper, and occurring, also, in other plants of the Nat. Ord. *Piperaceæ*.

Description.—Colorless or pale-yellowish, shining, four-sided prisms, permanent in the air; odorless; almost tasteless when first put in the mouth, but, on prolonged contact, producing a sharp and biting sensation; neutral reaction.

Preparation.—Pepper is treated with alcohol; the tincture evaporated to an extract; the extract treated with an alkaline solution, to saponify oleaginous matter; washing the undissolved portion with cold water; filtering; treating the matter left on the filter with alcohol, and evaporating the

resulting solution spontaneously or by gentle heat; and, finally, purifying the crystals of piperine deposited by alternate solution in alcohol or ether, and crystallizing.

Piperine is decomposed by alkalies in alcoholic solution into *piperic acid*, $C_{12}H_{10}O_4$, and *piperidine*, $C_5H_{11}N$.

MATICO, U. S.—Matico.—The leaves of *Artanthe elongata* contain about 2 per cent. of volatile oil, a pungent resin, a crystalline principle, *artanthic acid* and tannin.

Extractum Matico Fluidum, U. S.—Fluid Extract of Matico.

Tinctura Matico, U. S.—Tincture of Matico.

CUBEBA, U. S.—Cubeb.—The unripe fruit of *Cubeba officinalis* contains about 10 per cent. of volatile oil, 3 per cent. of resin, cubebin, *cubebic acid*, wax, fat, etc.

Extractum Cubebæ Fluidum, U. S.—Fluid Extract of Cubeb.

Oleoresina Cubebæ, U. S.—Oleoresin of Cubeb.

Trochisci Cubebæ, U. S.—Troches of Cubeb.

Tinctura Cubebæ, U. S.—Tincture of Cubeb.

OLEUM CUBEBÆ, U. S—Oil of Cubeb.—A volatile oil distilled from cubeb. A colorless, or pale greenish or yellowish liquid; having the characteristic odor of cubeb; a warm, camphoraceous, aromatic taste, and a neutral reaction; sp. gr. 0.920.

The oil contains a small amount of a hydrocarbon, $C_{10}H_{16}$, and two oils of the formula $C_{15}H_{24}$, one of which unites with HCl, while the other does not. Upon standing, it sometimes deposits rhomboidal prismatic crystals of a stearopten.

CAPSICUM, U. S.—Capsicum. (*Cayenne Pepper. African Pepper*).—The fruit *Capsicum fastigiatum*, containing capsaicin, $C_9H_{14}O_2$, traces of a volatile alkaloid and a volatile oil, fixed oil, resin, coloring matter, etc. *Capsaicin* is in colorless crystals, volatile, intensely acrid, and soluble in alcohol, ether and fixed oils.

Emplastrum Capsici, U. S.—Capsicum Plaster.

Extractum Capsici Fluidum, U. S.—Fluid Extract of Capsicum.

Oleoresina Capsici, U. S.—Oleoresin of Capsicum.

Tinctura Capsici, U. S.—Tincture of Capsicum.

COPAIBA, U. S.—Copaiba. (*Balsam of Copaiba.*)—The oleoresin of *Copaifera Langsdorffii* and of other species of *Copaifera* contains *copaivic acid*, volatile oil and a bitter principle. Copaivic acid, $C_{20}H_{30}O_2$, the resinous mass left after distilling the oil, forms a series of amorphous salts.

Description.—A transparent or translucent, more or less viscid liquid, of a color varying from pale yellow to brownish yellow; sp. gr. 0.940 to 0.993; peculiar aromatic odor; persistently bitter and acrid taste.

Massa Copaibæ, U. S.—Mass of Copaiba.

Resina Copaibæ, U. S.—Resin of Copaiba.

OLEUM COPAIBÆ, U. S.—Oil of Copaiba.—A volatile oil distilled from copaiba.

It is a colorless or pale yellowish liquid, having the characteristic odor of copaiba; a pungent, bitterish taste, and a neutral reaction; sp. gr. about 0.890. A hydrocarbon, consisting of $C_{10}H_{16}$ and $C_{15}H_{24}$.

OLEUM SANTALI, U. S.—Oil of Santal. (*Oil of Sandal Wood.*)—A volatile oil distilled from the wood of *Santalum album*.

A pale yellowish or yellow liquid, of a peculiar, strongly aromatic odor, a pungent and spicy taste, and slightly acid reaction; sp. gr. about 0.945. An oxygenated oil, consisting of $C_{15}H_{24}O$ and $C_{15}H_{26}O$.

OLEUM RUTÆ, U. S.—Oil of Rue.—A volatile oil distilled from *Ruta graveolens*.

A colorless or greenish-yellow liquid; of a characteristic, aromatic odor; a pungent, bitterish taste, and a neutral reaction; sp. gr. about 0.880.

This oil has been proved to be methyl-nonyl-ketone, $CH_3.CO.C_9H_{19}$.

SCOPARIUS, U. S.—Scoparius. (*Broom.*)—The tops of *Sarothamnus scoparius* contain a volatile oil, *sparteine*, $C_{15}H_{26}N_2$ (bitter oil), *scoparin*, $C_{21}H_{22}O_{10}$, fat, tannin, wax, etc.

BUCHU, U. S.—Buchu.—The leaves of *Barosma betulina* Bartling, *Barosma crenulata* Hooker, and *Barosma serratifolia* Willdenow, contain a volatile oil and resin, a bitter principle, mucilage, etc. The stearopten *diosphenol* is colored dark green by ferric chloride.

Extractum Buchu Fluidum, U. S.—Fluid Extract of Buchu.

SERPENTARIA, U. S.—Serpentaria. (*Virginia Snakeroot.*)—The rhizome and rootlets of *Aristolochia serpentaria* Linné and of *Aristolochia reticulata* Nuttall, contain 1 per cent. of volatile oil, a bitter principle, starch, sugar, etc.

Extractum Serpentariæ Fluidum, U. S.—Fluid Extract of Serpentaria.

Tinctura Serpentariæ, U. S.—Tincture of Serpentaria.

HUMULUS, U. S.—Hops.—The strobiles of *Humulus lupulus* contain a small quantity of volatile oil; their bitterness is due to the resin and lupulin present.

Tinctura Humuli, U. S.—Tincture of hops.

LUPULINUM, U. S. — Lupulin. (*Lupulina, Pharm. 1870.*)—The glandular powder separated from the strobiles of *Humulus lupulus* contains 10 per cent. of volatile oil, which, on exposure, yields valerianic acid, trimethylamine, a bitter principle (lupamaric acid), $C_{82}H_{50}O_7$, resin, wax, and an alkaline liquid termed *lupuline*.

Extractum Lupulinæ Fluidum, U. S.—Fluid Extract of Lupulin.

Oleoresina Lupulini, U. S.—Oleoresin of Lupulin.

CANNABIS INDICA, U. S.—Indian Cannabis. (*Indian Hemp.*)—The flowering tops of the female plant of *Cannabis sativa*, grown in the East Indies, contain a resinous substance, *cannabinine*, volatile oil and tetanocannabinine.

Extractum Cannabis Indicæ, U. S.—Extract of Indian Cannabis.

Extractum Cannabis Indicæ Fluidum, U. S.—Fluid Extract of Indian Cannabis.

Tinctura Cannabis Indica, U. S.—Tincture of Indian Cannabis.

CANNABIS AMERICANA, U. S.—American Cannabis.—*Cannabis sativa* Linné, grown in the Southern United States and collected while flowering, contains resin and a trace of volatile oil.

VALERIANA, U. S.—Valerian.—The rhizome and rootlets of *Valeriana officinalis* contain about 1 per cent. of volatile oil, valerianic acid, resin, starch, tannin, etc; there are also present some acetic and formic acids.

Abstractum Valerianæ, U. S.—Abstract of Valerian.

Extractum Valerianæ Fluidum, U. S.—Fluid Extract of Valerian.

Tinctura Valerianæ, U. S.—Tincture of Valerian.

Tinctura Valerianæ Ammoniata, U. S.—Ammoniated Tincture of Valerian.

OLEUM VALERIANÆ, U. S.—Oil of Valerian.—An oxygenated oil, having a slightly acid reaction, and a sp. gr. about 0.950. It consists of a terpene, $C_{10}H_{16}$, and a liquid compound, $C_{10}H_{18}O$, which, by means of chromic acid, affords common camphor and formic, acetic and valerianic acids, which are met with in old valerian root, owing, no doubt, to the slow oxidation of the compound $C_{10}H_{18}O$. A crystallizable compound of the same composition, probably *borneol*, is also found in the oil. (Remington.)

VIBURNUM, U. S.—Viburnum. (*Black Haw.*)—The bark of *Viburnum prunifolium* contains valerianic acid, a bitter, resinous principle, *viburnin*, tannin, sugar, etc.

Extractum Viburni Fluidum, U. S.—Fluid Extract of Viburnum.

SAMBUCUS, U. S.—Sambucus. (*Elder.*)—The flowers of *Sambucus canadensis* contain a little volatile oil and resin, sugar, mucilage, etc.

CHENOPODIUM, U. S.— Chenopodium. (*American Wormseed.*)—The fruit of *Chenopodium ambrosioides* contains a volatile oil, a small quantity of resin and a bitter extractive.

OLEUM CHENOPODII, U. S.—Oil of Chenopodium. (*Oil of American Wormseed.*)—A volatile oil distilled from chenopodium.

A thin, colorless or yellowish liquid; of a peculiar, aromatic odor; a pungent and bitterish taste, and a neutral reaction; sp. gr. about 0.920, increasing by age.

This oil consists of a terpene, $C_{10}H_{16}$, and an oxygenated portion, $C_{10}H_{18}O$.

JUNIPERUS, U. S.—Juniper.— The fruit of *Juniperus communis* contains a volatile oil and resins, also juniperin, wax, mucilage, fat, etc.

OLEUM JUNIPERI, U. S.—Oil of Juniper.—A volatile oil distilled from juniper.

A colorless or faintly greenish-yellow liquid, becoming darker and thicker by age and exposure to air; having the characteristic odor of juniper; a warm, aromatic, somewhat terebinthinate and sweetish taste, and a neutral reaction; sp. gr. about 0.870.

Oil of juniper (berries) is a terpene, $C_{10}H_{16}$.

Spiritus Juniperi, U. S.—Spirit of Juniper.

Spiritus Juniperi Compositus, U. S.—Compound Spirit of Juniper.

SABINA, U. S.—Savine.—The tops of *Juniperus sabina* contain a terpene, $C_{10}H_{16}$, and resin, with a trace of tannin.

Extractum Sabinæ Fluidum, U. S.—Fluid Extract of Savine.

OLEUM SABINÆ, U. S.—Oil of Savine.—A volatile oil distilled from savine. A colorless or yellowish liquid, becoming darker and thicker by age and exposure to air; having a peculiar terebinthinate odor; a pungent, bitterish and camphoraceous taste, and a neutral reaction; sp. gr. about 0.910.

This oil is a terpene, $C_{10}H_{16}$.

THUJA, U. S.—Thuja. (*Arbor Vitæ.*)—The fresh tops of *Thuja occidentalis* yield volatile oil, resin, pinipicrin and *thujin*, $C_{20}H_{22}O_{12}$.

Officinal Drugs and Products Containing Volatile Oil, Associated with Bitter Principle or Extractive.

ABSINTHIUM, U. S.—Absinthium. (*Wormwood.*)—The leaves and tops of *Artemisia absinthium* contain 1 per cent. of an oxygenated volatile oil, which is chiefly absinthol, $C_{10}H_{16}O$. The bitter principle is *absinthin*, $C_{40}H_{58}O_9$. It also contains tannin, resin and succinic acid.

TANACETUM, U. S.—Tansy.—The leaves and tops of *Tanacetum vulgare* contain a small quantity of volatile oil, which is freely soluble in alcohol. The bitter principle is *tanacetin*. It also contains tannin, fat, resin, etc.

ARNICÆ FLORES, U. S.—Arnica Flowers.—The flower heads of *Arnica montana* contain a trace of volatile oil, and a bitter principle, *arnicin*, with resin, coloring-matter, etc.

Tinctura Arnicæ Florum, U. S.—Tincture of Arnica Flowers.

ARNICÆ RADIX, U. S.—Arnica Root.—The rhizome and rootlets of *Arnica montana* contain about 1 per cent. of volatile oil, the bittter principle *arnicin*, acrid resin, tannin, etc.

Extractum Arnicæ Radicis, U. S.—Extract of Arnica Root.

Emplastrum Arnicæ, U. S.—Arnica Plaster.

Extractum Arnicæ Radicis Fluidum, U. S.—Fluid Extract of Arnica Root.

Tinctura Arnicæ Radicis, U. S.—Tincture of Arnica Root.

CALENDULA, U. S.—Calendula. (*Marigold.*)—The fresh, flowering herb of *Calendula officinalis* contains a small quantity of a volatile oil, a bitter principle, gum, sugar, etc. *Calendulin* is not the active principle, having very little taste.

Tinctura Calendulæ, U. S.—Tincture of Calendula.

OLEUM ERIGERONTIS, U. S.—Oil of Erigeron. (*Oil of Fleabane.*)—A volatile oil distilled from the fresh flowering herb of *Erigeron canadense*. A pale-yellow liquid, becoming darker and thicker by age and exposure to air; having a peculiar, aromatic, persistent odor; an aromatic, slightly pungent taste, and a neutral reaction; sp. gr. about 0.850.

This oil consists of a terpene, $C_{10}H_{16}$, and an oxygenated portion.

INULA, U. S.—Inula. (*Elecampane.*)—The root of *Inula helenium* contains acrid resin and a volatile oil, which are the active principles. Helenin, C_6H_8O, is inert. *Inulin*, a kind of starch, is abundant.

ANTHEMIS, U. S.—Anthemis. (*Chamomile.*)—The flower-heads of *Anthemis nobilis*, collected from cultivated plants, contain a volatile oil, and a bitter principle, which has been called *anthemic acid*.

MATRICARIA, U. S.—Matricaria. (*German Chamomile.*)—The flower heads of *Matricaria chamomilla* contain a dark-blue volatile oil; the bitter principle is termed *anthemic acid*.

EUPATORIUM, U. S.—Eupatorium (*Thoroughwort, Boneset.*)—The leaves and flowering tops of *Eupatorium perfoliatum* contain a volatile oil and resin, *eupatorin*, gum, tannin, sugar, etc.

Extractum Eupatorii Fluidum, U. S.—Fluid Extract of Eupatorium.

GRINDELIA, U. S.—Grindelia.—The leaves and flowering tops of *Grindelia robusta* contain a volatile oil and a bitter and resinous principle.

Extractum Grindeliæ Fluidum, U. S.—Fluid Extract of Grindelia.

MEZEREUM, U. S.—Mezereum.—The bark of *Daphne Mezereum* and other species of *Daphne* contains *daphnin*, $C_{31}H_{34}O_{19}$, a glucoside, associated with an acrid, soft resin and oil.

Extractum Mezerei Fluidum, U. S.—Fluid Extract of Mezereum.

Extractum Mezerei, U. S.—Extract of Mezereum.

Unguentum Mezerei, U. S.—Mezereum Ointment.

ASPIDIUM, U. S.—Aspidium. (*Filix Mas, Pharm. 1870. Male Fern.*)—The rhizome of *Aspidium Filix mas* Swartz, and of *Aspidium marginale* Willdenow, contains *filicic acid*, $C_{14}H_{18}O_5$, filix red, filitannic acid, fixed oil, etc.

Oleoresina Aspidii, U. S.—Oleoresin of Aspidium.

CYPRIPEDIUM, U. S.—Cypripedium. (*Ladies' Slipper*).—The rhizome and rootlets of *Cypripedium pubescens* Willdenow, and of *Cypripedium parviflorum* Salisbury, contain resins, an acid principle, volatile oil, tannin, starch, etc.

Extractum Cypripedii Fluidum, U. S.—Fluid Extract of Cypripedium.

PHYTOLACCÆ RADIX, U. S.—Phytolacca Root. (*Poke Root.*)—The root of *Phytolacca decandra* contains an acrid resin, tannin, mucilage, etc.

PHYTOLACCÆ BACCA, U. S.—Phytolacca Berry. (*Poke Berry.*)—The fruit of *Phytolacca decandra* contains reddish-purple coloring matter, sugar, gum, etc.

STILLINGIA, U. S.—Stillingia. (*Queen's Root*).—The root of *Stillingia sylvatica* contains an acrid resin, starch, fixed oil, gum, etc.

Extractum Stillingiæ Fluidum, U. S.—Fluid Extract of Stillingia.

MAGNOLIA, U. S.—Magnolia.—The bark of *Magnolia glauca, Magnolia acuminata* and *Magnolia tripetala* contains *magnolin*, a crystalline principle having an acrid taste, also pungent, soft resin, tannin, etc.

PYRETHRUM, U. S.—Pyrethrum. (*Pellitory.*)—The root of *Anacyclus pyrethrum* contains an acrid, brown resin and fixed oils, inulin, mucilage, etc.

Tinctura Pyrethri, U. S.—Tincture of Pyrethrum.

XANTHOXYLUM, U. S.—Xanthoxylum. (*Prickly Ash.*)—The bark of *Xanthoxylum fraxineum* Willdenow, and of *Xanthoxylum carolinianum* Lambert, contains a soft resin, a crystalline resin, a bitter principle and an acrid, green oil.

Extractum Xanthoxyli Fluidum, U. S.—Fluid Extract of Xanthoxylum.

IRIS, U. S.—Iris. (*Blue Flag.*)—The rhizome and rootlets of *Iris versicolor* contain a bitter resin. There are also present sugar, gum, tannin and fatty matter.

Extractum Iridis Fluidum, U. S.—Fluid Extract of Iris.

Extractum Iridis, U. S.—Extract of Iris.

CIMICIFUGA, U. S.—Cimicifuga. (*Black Snakeroot.*)—The rhizome and rootlets of *Cimicifuga racemosa* contain resin, an acrid principle (possibly an alkaloid), starch, tannin, gum, etc.

Extractum Cimicifugæ Fluidum, U. S.—Fluid Extract of Cimicifuga.

Tinctura Cimicifugæ, U. S.—Tincture of Cimicifuga.

PULSATILLA, U. S.—Pulsatilla.—The herb of *Anemone pulsatilla* and *Anemone pratensis* Linné and of *Anemone patens* Linné, var. *Nuttalliana* Gray, collected soon after flowering. Should be carefully

preserved, and not be kept longer than one year; contains an acrid, odorous, resinous substance, coloring matter, gum, etc. The acrid principle may be converted into *anemonin*, $C_{15}H_{12}O_6$, which, through the action of alkalies, becomes anemonic acid.

APOCYNUM, U. S.—Apocynum. (*Canadian Hemp.*)—The root of *Apocynum cannabinum* contains resin, *apocynin*, *apocynein*, bitter extractive, tannin, etc.

ASCLEPIAS, U. S.—Asclepias. (*Pleurisy Root.*)—The root of *Asclepias tuberosa* contains resins, volatile principle, tannin, mucilage, etc.

LACTUCARIUM, U. S.—Lactucarium. (*Lettuce.*)—The concrete milk-juice of *Lactuca virosa* contains a bitter, resinous principle, *lactucin*, $C_{11}H_{12}O_3.H_2O$, *lactucic acid* (bitter and crystalline), *lactucopicrin* (bitter and amorphous), *lactucerin* in large quantity, nearly 60 per cent. (this principle is inert and crystallizable), caoutchouc, resin, asparagin, volatile oil, mucilage, etc.

Extractum Lactucarii Fluidum, U. S.—Fluid Extract of Lactucarium.

Syrupus Lactucarii, U. S.—Syrup of Lactucarium.

RESINS, OLEORESINS, GUM-RESINS AND BALSAMS.

What are Resins? Natural or induced solid or semi-solid exudations from plants, characterized by being insoluble in water, mostly soluble in alcohol, uncrystallizable, and softening and melting at a moderate heat.

What are they chemically? Mixed products. Some of them are acids, and combine with alkalies, forming soaps, as in the case of common rosin. They are commonly the oxidized terpenes of plants.

Describe them. When pure, they are usually transparent, hard and brittle; when they contain water, are opaque and no longer hard and brittle.

Into what three Classes are they usually Divided? Natural Oleoresins (oil and resin), generally obtained by incising the trunks of trees which contain them; ex., turpentine. Gum Resins, natural mixtures of gum and resin—usually exudations from plants; ex., myrrh. Balsams, resinous substances which contain benzoic, cinnamic or analogous acids; ex., balsam of tolu.

TEREBINTHINA, U. S.—Turpentine.—A concrete oleoresin obtained from *Pinus australis* and from other species of *Pinus;* contains abietic anhydride, which may be converted into abietic acid, $C_{44}H_{64}O_5$, a bitter principle, and 25 per cent. of volatile oil.

OLEUM TEREBINTHINÆ, U. S.—Oil of Turpentine.—A volatile oil distilled from turpentine; has the composition $C_{10}H_{16}$, and is the type of the terpenes. It is a thin, colorless liquid, of a characteristic odor and taste, becoming stronger and less pleasant by age and exposure to air, and of a neutral or faintly acid reaction; sp. gr. 0.855 to 0.870.

Linimentum Terebinthinæ, U. S.—Turpentine Liniment.

RESINA, U. S.—Resin. (*Colophony.*)—The residue left after distilling off the volatile oil from turpentine consists of abietic anhydride, which passes into abietic acid when treated with diluted alcohol. It is a transparent, amber-colored substance, hard, brittle, with a glossy and shal-

low conchoidal fracture, and having a faintly terebinthinate odor and taste; sp. gr. 1.070 to 1.080.

Ceratum Resinæ, U. S.—Resin Cerate.

Emplastrum Resinæ, U. S.—Resin Plaster.

TEREBINTHINA CANADENSIS, U. S.—**Canada Turpentine.** (*Balsam of Fir.*)—A liquid oleoresin obtained from *Abies balsamea*. It contains resin, associated with a terpene, $C_{10}H_{16}$, and a small quantity of a bitter principle. It is a yellowish or faintly greenish, transparent, viscid liquid; of an agreeable, terebinthinate odor, and a bitterish, slightly acrid taste.

MASTICHE, U. S.—**Mastic.**—A concrete, resinous exudation from *Pistacia Lentiscus*, containing a resin (masticbic acid, $C_{20}H_{32}O_2$), which is soluble in strong alcohol; also masticin, a resinous principle, which is insoluble in alcohol; a small quantity of volatile oil is likewise present.

PIX BURGUNDICA, U. S.—**Burgundy Pitch.**—The prepared, resinous exudation of *Abies excelsa* contains resin, a small quantity of a terpene, $C_{10}H_{16}$, and water.

Emplastrum Picis Burgundicæ, U. S.—Burgundy Pitch Plaster.

Emplastrum Picis cum Cantharide, U. S.—Pitch Plaster with Cantharides.

PIX CANADENSIS, U. S.—**Canada Pitch.** (*Hemlock Pitch.*)—The prepared resinous exudation of *Abies canadensis* contains resins, a small quantity of a terpene, $C_{10}H_{16}$, and water.

Emplastrum Picis Canadensis, U. S.—Canada Pitch Plaster.

GUTTA-PERCHA, U. S.—**Gutta-Percha.**—The concrete exudation of *Isonandra gutta* consists almost entirely of resinous substances, one of which is crystalline.

Liquor Gutta-Perchæ, U. S.—Solution of Gutta-Percha.

AMMONIACUM, U. S.—**Ammoniac.**—A gum resin obtained from *Dorema Ammoniacum;* contains about 25 per cent. of gum, 70 per cent. of resin and about 3 per cent. of volatile oil. The resin is remarkable for yielding resorcin when fused with potassa.

Mistura Ammoniaci, U. S.—Ammoniac Mixture.

Emplastrum Ammoniaci, U. S.—Ammoniac Plaster.

Emplastrum Ammoniaci cum Hydrargyro, U. S.—Ammoniac Plaster with Mercury.

ASAFŒTIDA, U. S.—**Asafetida.**—A gum resin obtained from the root of *Ferula narthex* Boissier, and of *Ferula scorodosma* Bentham et Hooker. It contains a sulphurated volatile oil (ferulyl sulphide), about 20 per cent. of gum and 70 per cent. of resin.

Mistura Asafœtidæ, U. S.—Asafetida Mixture.

Tinctura Asafœtidæ, U. S.—Tincture of Asafetida.

Emplastrum Asafœtidæ, U. S.—Asafetida Plaster.

Pilulæ Asafœtidæ, U. S.—Pills of Asafetida.

MYRRHA, U. S.—**Myrrh.**—A gum-resin obtained from *Balsamodendron myrrha:* contains 3 per cent. of an oxygenated volatile oil, a bitter principle, and about 30 per cent.of gum and 60 per cent. of resin.

Tinctura Myrrhæ, U. S.—Tincture of Myrrh.

GALBANUM, U. S.—**Galbanum.**—The gum-resin obtained from *Ferula galbaniflua*, and, probably, from other allied plants, contains 8 per

cent. of volatile oil ($C_{10}H_{16}$), 20 per cent. of gum and 65 per cent. of resin, which is converted into resorcin by treatment with potassa, and which yields umbelliferone, $C_9H_6O_3$, by dry distillation.

Emplastrum Galbani, U. S.—Galbanum Plaster.

Pilulæ Galbani Compositæ, U. S.—Compound Pills of Galbanum.

GUAIACI LIGNUM, U. S.—Guaiacum Wood.—The heart-wood of *Guaiacum officinale* and of *Guaiacum sanctum* owes its virtues to resin, which is present, usually, to the amount of 25 per cent.

GUAIACI RESINA, U. S.—Guaiac.—The resin of the wood of *Guaiacum officinale* consists of *guaiacic acid* ($C_{12}H_{16}O_6$), *guaiaconic acid* ($C_{19}H_{20}O_5$), *guaiaretic acid* ($C_{20}H_{26}O_4$), beta resin, gum, etc.

Tinctura Guaiaci, U. S.—Tincture of Guaiac.

Tinctura Guaiaci Ammoniata, U. S.—Ammoniated Tincture of Guaiac.

BALSAMUM TOLUTANUM, U. S.—Balsam of Tolu.—A balsam obtained from *Myroxylon toluifera* contains *cinnamic* and *benzoic acids*, resins, a volatile oil called *benzyl benzoate*, $C_7H_5(C_7H_7)O_2$, *benzyl cinnamate*, a terpene, $C_{10}H_{16}$, termed *tolene*, and other unimportant constituents.

Tinctura Tolutana, U. S.—Tincture of Tolu.

Syrupus Tolutanus, U. S.—Syrup of Tolu.

BALSAMUM PERUVIANUM, U. S.—Balsam of Peru.—The balsam obtained from *Myroxylon peruiræ* contains *cinnamic* and *benzoic acids*, *benzyl cinnamate*, $C_9H_7(C_7H_7)O_2$, resin, *benzyl benzoate*, stilbene, etc.

Description.—A thick liquid, brownish-black in bulk, reddish-brown and transparent in thin layers, having a syrupy consistence; somewhat smoky, but agreeable and balsamic, odor; warm, bitter, afterward acrid taste.

BENZOINUM, U. S.—Benzoin.—The balsamic resin obtained from *Styrax benzoin* contains benzoic acid, cinnamic acid ($C_9H_8O_2$), a fragrant, volatile oil, and resins; in some varieties vanillin is found.

Adeps Benzoinatus, U. S.—Benzoinated Lard.

Tinctura Benzoini, U. S.—Tincture of Benzoin.

Tinctura Benzoini Composita, U. S.—Compound Tincture of Benzoin.

STYRAX, U. S.—Storax.—The balsam prepared from the inner bark of *Liquidambar orientalis* contains cinnamic acid, benzoic acid, *styracin*, $C_9H_7(C_9H_9)O_2$, *storesin*, $C_{36}H_{58}O_3$, *ethyl cinnamate*, $C_9H_7(C_2H_5)O_2$, *phenyl-propyl cinnamate*, $C_9H_7(C_9H_{17})O_2$, *styrol*, C_8H_8, a fragrant hydrocarbon, and a resinous substance not yet investigated.

ACIDUM BENZOICUM, U. S.—Benzoic Acid. $HC_7H_5O_2$; 122.—White, lustrous scales, or friable needles, permanent in the air; slight aromatic odor of benzoin; a warm, acid taste; acid reaction. It is found natural in benzoin, balsam of tolu, etc., but is usually made artificially—

1. From the urine of cattle, by treating it with lime, evaporating, decomposing the lime hippurate with HCl, purifying the hippuric acid with animal charcoal, and treating with HCl, when benzoic acid and glycocine are produced.

$$\underset{\text{Hippuric Acid.}}{C_9H_9NO_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Benzoic Acid.}}{C_7H_6O_2} + \underset{\text{Glycocine.}}{C_2H_5NO_2}.$$

2. From *naphthalin*, $C_{10}H_8$, by treating it with HNO_3; *phthalic* acid is produced, which, when heated with excess of $Ca(HO)_2$, yields calcium benzoate and carbonate.

$$\underset{\text{Phthalic Acid.}}{C_8H_6O_4} = \underset{\text{Benzoic Acid.}}{C_7H_6O_2} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

3. From trichlormethyl benzol, a coal tar hydrocarbon from toluol, C_7H_8, by heating with zinc chloride and acetic acid, by which benzoic acid is formed, and HCl is liberated.

FIXED OILS, FATS AND SOAPS.

What is the Source of Fixed Oils and Fats, and how are they Distinguished? They are obtained from both the vegetable and animal kingdoms. *Characteristics.*—Greasy to the touch, leave a permanent oily stain on paper, insoluble in water, but soluble in ether, chloroform, carbon disulphide, benzol, benzin, turpentine and volatile oils, usually mixing with one another without separating; when pure, generally colorless or of a pale yellow color, with distinctive odor and taste, often caused by impurities, as they are rendered odorless and tasteless by refining them. When heated moderately, if solid, they melt; if liquid, they become thinner; decomposed by heating strongly in the air, with evolution of offensive vapors, they burn with a sooty flame and much heat. Sp. gr. 0.870 to 0.985. On exposure to air, they acquire an acrid, disagreeable taste and acid reaction, owing to a change that occurs, termed rancidity, believed to be due to impurities, like albuminous substances, which act as ferments, induce decomposition, liberate the fatty acids, and produce volatile, odorous acids, like caproic, caprylic, butyric and valerianic acids. Rancid oils may often be purified by shaking thoroughly with hot water, then with a cold solution of CO_3, and washing with cold water.

What are Fixed Oils chemically? They are ethers of the higher members of the fatty acids, the alcohol being glycerin and the radical glyceryl. As they consist, in most cases, of two or three proximate principles, called olein, palmitin or stearin in combination with glyceryl, they are sometimes called glycerides of oleic, palmitic and stearic acids. The consistency of fixed oils and fat vary, on account of these proximate principles, which occur in various proportions. Olein is liquid, the other two solid. Almond oil being principally composed of olein, is, at ordinary temperatures, liquid; tallow being largely stearin, is solid at the same temperatures.

What is Olein? The oleate of the triad radical glyceryl, having the chemical composition $C_3H_5(OC_{18}H_{33}O_2)_3$, obtained by treating oils or fats with boiling alcohol, cooling, to deposit the concrete principles, the olein remaining in solution, which is obtained by evaporating off the alcohol, or by compressing one of the solid fats, or a liquid fat concreted by cold, between folds of bibulous paper, which absorb the olein and give it up afterward by compressing under water.

Describe Olein. It is a liquid of oily consistence, congealing at —6° C. (21.2° F.); colorless, when pure; with little odor and a sweetish taste; insoluble in water, soluble in boiling alcohol and ether.

What is Palmitin? The glyceride of palmitic acid, or tripalmitate of glyceryl.

What is Stearin? A glyceride of stearic acid, $C_3H_5(OC_{18}H_{30}O)_3$, and has been formed synthetically by heating a mixture of these two materials to 280°–300° C.

Describe it and its Method of Preparation. A white, opaque mass, of a pearly appearance as crystallized from ether, pulverizable, fusible at 66.5° C. (152° F.), soluble in boiling alcohol and ether, nearly insoluble in those liquids cold, insoluble in water. Prepared by dissolving suet in hot oil of turpentine, cooling, expressing with unsized paper, dissolving in hot ether, which deposits the stearin on cooling.

What is Margarin? A compound of stearin and palmitin—once regarded as a principle.

What is Stearic Acid? A firm, white solid, like wax, with chemical composition, $C_{18}H_{36}O_2$, fusible at 69.2° C. (157° F.). greasy to the touch, pulverizable, soluble in alcohol, very soluble in ether, insoluble in water.

Describe Palmitic Acid. Palmitic acid, $C_{16}H_{32}O_2$, forms a white, scaly mass, melting at 62° C. (143.6° F.).

Describe Oleic Acid. An oily liquid, soluble in alcohol and ether, lighter than water, in which it is insoluble; crystallizable in needles at a temperature a little below zero C. (32° F.); having a slight smell and pungent taste; chemical composition, $C_{18}H_{34}O_2$.

AMYGDALA DULCIS, U. S.—Sweet Almond.—The seed of *Amygdalus communis*, var. *dulcis*, contains about 40 per cent. of fixed oils, protein compounds (*conglutin* and *amandin*), sugar, mucilage, etc.

Mistura Amygdalæ, U. S.—Almond mixture.

Syrupus Amygdalæ, U. S.—Syrup of Almond.

OLEUM AMYGDALÆ EXPRESSUM, U. S.—Expressed Oil of Almond.—A fixed oil expressed from bitter or sweet almond. Clear and colorless, or slightly tinged of a greenish yellow; nearly inodorous; bland, sweetish taste; its sp. gr. is from 0.914 to 0.920. It consists principally of olein, 70 per cent.

OLEUM OLIVÆ, U. S.—Olive Oil.—A fixed oil, expressed from the ripe fruit of *Olea Europæa*. It is a pale yellow or light greenish-yellow, oily liquid; almost devoid of odor; nutty, oleaginous taste, with a faintly acrid after-taste; neutral reaction.

OLEUM GOSSYPII SEMINIS, U. S.—Cotton Seed Oil.—A fixed oil expressed from the seed of *Gossypium herbaceum*, and other species of *Gossypium*, and subsequently purified.

OLEUM SESAMI, U. S.—Oil of Sesamum. (*Benné Oil.*)—The fixed oil expressed from the seed of *Sesamum indicum* consists of olein (70 per cent.), palmitin, stearin and myristicin.

OLEUM LINI, U. S.—Oil of Flaxseed. (*Linseed Oil.*)—A fixed oil expressed from flaxseed without the use of heat. It consists mainly of *linolein*, which, by exposure, becomes *lynoxyn*, $C_{32}H_{54}O_{11}$; *myristin* and *palmitin* are also present. It is a yellowish or yellow, oily liquid, having a slight, peculiar odor, a bland taste and a neutral reaction.

PEPO, U. S.—Pumpkin Seed.—The seed of *Cucurbita pepo* contains about 40 per cent. of fixed oil, starch, protein compounds, a little acrid resin, sugar, etc.

OLEUM RICINI, U. S.—Castor Oil.—A fixed oil expressed from the seed of *Ricinus communis*.

Preparation.—Castor oil has been obtained from the seed in four ways: 1. By cold expression; 2. By expression with heat; 3. By percolation with alcohol; 4. By decoction. The first method produces the best oil. It is an almost colorless, transparent, viscid liquid; of a faint, mild odor; a bland, afterward slightly acrid, and generally offensive, taste, and a neutral reaction; sp. gr. 0.950 to 0.970. It contains *ricinolein* and palmitin.

OLEUM TIGLII, U. S.—Croton Oil.—A fixed oil expressed from the seed of *Croton tiglium*. It is a pale yellow or brownish-yellow, somewhat viscid and slightly fluorescent liquid; having a slight fatty odor; a mild, oily, afterward acrid, burning taste, and a slightly acid reaction; sp. gr. 0.940 to 0.955. Neither the purgative principle nor the vesicating principle has been isolated. *Crotonol*, $C_{18}H_{28}O_4$, is said to be present.

OLEUM THEOBROMÆ, U. S.—Oil of Theobroma. (*Butter of Cacao.*)—A fixed oil expressed from the seed of *Theobroma cacao* by expressing the kernels of the "chocolate nut" between hot iron plates, and running the product into moulds. The yield is about 40 per cent. It is a yellowish-white solid, having a faint, agreeable odor; a bland, chocolate-like taste, and a neutral reaction. It melts between 30° and 35° C. (86° to 95° F.).

Chemically, it is a mixture of stearin, palmitin, olein, arachin and laurin, and, owing to its low fusing point, and its property of becoming solid at a temperature just above the fusing point, it is valuable in pharmacy in making suppositories.

LYCOPODIUM, U. S.—Lycopodium.—The sporules of *Lycopodium clavatum* and of other species of *Lycopodium* contain 47 per. cent. of fixed oil, with minute quantities of volatile bases.

ACIDUM OLEICUM, U. S.—Oleic Acid. $HC_{18}H_{33}O_2$; 282.—A yellowish, oily liquid, gradually becoming brown, rancid and acid when exposed to air; odorless, or nearly so; tasteless; when pure, of a neutral reaction; sp. gr. 0.900 to 0.910. Obtained as a by-product in the manufacture of candles from fats.

Red oil is crude oleic acid.

GLYCERINUM, U. S.—Glycerin. (*Glycerina, Pharm. 1870.*)—A clear, colorless liquid, of syrupy consistence, oily to the touch, hygroscopic; odorless; very sweet and slightly warm to the taste; neutral reaction. Obtained by the decomposition of fats or fixed oils, and containing not less than 95 per cent. of absolute glycerin ($C_3H_5(HO)_3$; 92).

Preparation.—Glycerin is made in several ways:—

1. Through the saponification of fats and oils, in making soap or lead plaster.

$$\underset{\substack{\text{Glyceryl Oleate}\\\text{(Olive Oil).}}}{2(C_3H_5C_{18}H_{33}O_2)} + \underset{\substack{\text{Lead Oxide}\\\text{(Litharge).}}}{3PbO} + \underset{\text{Water.}}{3H_2O} =$$

$$\underset{\substack{\text{Lead Oleate}\\\text{(Lead Plaster).}}}{3(Pb2C_{18}H_{33}O_2)} + \underset{\substack{\text{Glyceryl Hydrate}\\\text{(Glycerin).}}}{2(C_3H_53HO).}$$

2. By the decomposition of fats and oils through pressure and superheated steam, whereby the fats, which are *glycerides*, or ethers of the fatty

acids, are broken up into glycerin and fatty acids, the water supplying the elements of hydrogen and oxygen necessary for that change. The decomposition of *stearin* in this way will illustrate:—

$$\underset{\text{Stearin.}}{C_3H_5(C_{18}H_{35}O_2)_3} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Glycerin.}}{C_3H_5(OH)_3} + \underset{\text{Stearic Acid.}}{3HC_{18}H_{35}O_2}.$$

In this, its present form, it is known as *distilled glycerin*.

Glycerin is the hydrate of the radical *glyceryl*, therefore an alcohol; and is sometimes called *glycerol* or *glyceric alcohol*. It is triatomic, and one, two or three of the hydrogen atoms may be replaced by monad radicals.

SAPO, U. S.—Soap.—Soap prepared from soda and olive oil. It is a white or whitish solid, hard, yet easily cut when fresh; with a slight, peculiar odor; free from rancidity; disagreeable, alkaline taste; alkaline reaction.

Emplastrum Saponis, U. S.—Soap Plaster.

Linimentum Saponis, U. S.—Soap Liniment.

SAPO VIRIDIS, U. S.—Green Soap.—A soft soap, generally imported from Germany; prepared from potassa and various fixed oils containing but little stearin. It is a soft, greenish-yellow, unctuous jelly, having a peculiar odor, which should be free from rancidity, and an alkaline reaction.

Tinctura Saponis Viridis, U. S.—Tincture of Green Soap.

Unsaponifiable Fats and Petroleum Products.

PETROLATUM, U. S.—Petrolatum. (*Petroleum Ointment.*)—A yellowish or yellow, fat-like mass, transparent in thin layers, more or less fluorescent, especially when melted, completely amorphous; odorless, or giving off, at most, only a faint petroleum odor when heated; tasteless; neutral reaction. Consisting of hydrocarbons, chiefly of the marsh-gas series ($C_{16}H_{34}$; etc.). Obtained by distilling off the lighter and more volatile portions from American petroleum, and purifying the residue. Melting point about 40° C. to 51° C. (104° F. to 125° F.), the first constituting the softer and the second the firmer variety.

When petrolatum is prescribed or ordered without specifying its melting point, the low-melting variety, which liquefies at about 40° C. (104° F.), is to be dispensed.

Petrolatum is known commercially as *cosmoline*, *vaseline*, *petrolina*, *deodorolina*, etc.

PARAFFIN.—The degree of hardness of petrolatum is due to the greater or less proportion of paraffin present. This substance may be obtained in a pure form by distilling the residuum obtained from the refiners of petroleum, and collecting and purifying the distillate. In its pure state it is a white, waxy, inodorous, tasteless substance, harder than tallow, softer than wax. Sp. gr. 0.877; melting point ranges between 43° C. and 65° C. (109° F. and 151° F.).

BENZINUM, U. S.—Benzin. (*Petroleum Benzin. Petroleum Ether.*)—A transparent, colorless, diffusive liquid, with a strong, characteristic odor, slightly resembling that of petroleum, but much less disagreeable; neutral reaction. It is a purified distillate from American petroleum, consisting of hydrocarbons, chiefly of the marsh-gas series (C_5H_{12};

C_6H_{14}, and homologous compounds); having a sp. gr. from 0.670 to 0.675, and boiling at 50° to 60° C. (122° to 140° F.).

Benzin should be carefully kept in well-stoppered bottles or cans, in a cool place, remote from lights or fire; for it is highly inflammable, and its vapor, when mixed with air and ignited, explodes violently.

DRUGS CONTAINING GLUCOSIDES OR NEUTRAL PRINCIPLES, WITH THEIR PREPARATIONS.

Glucosides are bodies mostly found in plants yielding glucose, $C_6H_{12}O_6$, as one of their products of decomposition when heated in contact with a diluted mineral acid and water. The other product which is formed at the same time differs in character from the original glucoside. Thus, *Salicin*, if boiled with diluted sulphuric acid, yields dextro-glucose and *saligenin*, or *saligenol*.

$$\underset{\text{Salicin.}}{C_{13}H_{18}O_7} + \underset{\text{Water.}}{H_2O} = \underset{\text{Saligenin.}}{C_7H_8O_2} + \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

Glucosides may sometimes be split into glucose and the derived product by heating them with baryta water or alkaline solutions, by nitrogenous principles, which act as ferments, like *emulsin* or *synaptase*, or by treatment with yeast ferment or *ptyalin* found in saliva.

Glucosides are sometimes the active principles of the plants in which they are found, but they are more frequently associated with resins, oils, alkaloids and bitter principles. (Remington.)

GENTIANA, U. S.—**Gentian.**—The root of *Gentiana lutea* contains the glucoside *gentiopicrin* (which splits, when heated with dilute acids, into gentiogenin and grape sugar), *gentisic* acid, $C_{14}H_{10}O_5$, pectin, sugar (gentianose) and a little fixed oil.

Extractum Gentianæ Fluidum, U. S.—Fluid Extract of Gentian.

Extractum Gentianæ, U. S.—Extract of Gentian.

Tinctura Gentianæ Composita, U. S.—Compound Tincture of Gentian.

CALUMBA, U. S.—**Calumba.** (*Columbo.*)—The root of *Jateorrhiza calumba* owes its virtues to *colombin*, $C_{21}H_{22}O_7$, and *berberine*, both of which are very bitter; starch and colombic acid are present, with a mucilage which is often troublesome by interfering with percolating operations.

Extractum Calumbæ Fluidum, U. S.—Fluid Extract of Calumba.

Tinctura Calumbæ, U. S.—Tincture of Calumba.

QUASSIA, U. S.—**Quassia.** The wood of *Picræna excelsa* contains *quassin*, $C_{10}H_{12}O_3$, which is intensely bitter and soluble in both alcohol and water; there are also present resin, mucilage, etc.

Extractum Quassiæ Fluidum, U. S.—Fluid Extract of Quassia.

Extractum Quassiæ, U. S.—Extract of Quassia.

Tinctura Quassiæ, U. S.—Tincture of Quassia.

CHIRATA, U. S.—**Chirata.**—*Ophelia chirata* contains a bitter glucoside, *chiratin*, $C_{26}H_{48}O_{15}$, and a very bitter principle, ophelic acid, $C_{13}H_{20}O_{10}$.

Extractum Chiratæ Fluidum, U. S.—Fluid Extract of Chirata.

Tinctura Chiratæ, U. S.—Tincture of Chirata.

CORNUS, U. S.—Cornus. (*Dogwood.*)—The bark of the root of *Cornus florida* contains *cornin*, a bitter principle, tannin, gum and resin.

Extractum Cornus Fluidum, U. S.—Fluid Extract of Cornus.

SALIX, U. S.—Salix. (*Willow.*)—The bark of *Salix alba*, and of other species of *Salix*, owes its bitterness to *salicin*, $C_{13}H_{18}O_7$, a glucoside; it also contains tannin.

SALICINUM, U. S.—Salicin. $C_{13}H_{18}O_7$; 286.—Colorless, white, silky, shining crystals, permanent in the air; odorless; very bitter taste; neutral reaction. Prepared by removing gum, tannin and extractive matter from a boiling concentrated decoction of the bark by treating it with lead oxide, separating the portion of lead oxide dissolved in combination, probably with the salicin, with H_2SO_4 and BaS; filtering, evaporating and purifying the deposited salicin by repeated solution and crystallization. Salicin is a glucoside, splitting into saligenin and sugar under the influence of dilute acids and heat.

PRINOS, U. S.—Prinos. (*Black Alder.*)—The bark of *Prinos verticillatus* contains a bitter principle, resin, wax, tannin, starch, gum, etc.

TARAXACUM, U. S.—Taraxacum. (*Dandelion.*)—The root of *Taraxacum dens-leonis*, gathered in autumn, owes its bitterness to *taraxacin*, $C_8H_{16}O$, an acrid crystalline principle, soluble in alcohol and water. It also contains pectin, sugar, resin, gum, etc.

Extractum Taraxaci Fluidum, U. S.—Fluid Extract of Taraxacum.

Extractum Taraxaci, U. S.—Extract of Taraxacum.

LAPPA, U. S.—Lappa. (*Burdock.*)—The root of *Lappa officinalis* contains a bitter substance, inulin, sugar, mucilage, etc.

SCILLA, U. S.—Squill.—The sliced bulb of *Urginea scilla* contains the bitter principle *scillipicrin*, *scillitoxin*, *scillin* and *scillain*, a poisonous glucoside. There are also present a large quantity of mucilage, calcium oxalate, sinistrin, etc.

Acetum Scillæ, U. S.—Vinegar of Squill.

Extractum Scillæ Fluidum, U. S.—Fluid Extract of Squill.

Syrupus Scillæ, U. S.—Syrup of Squill.

Syrupus Scillæ Compositus, U. S.—Compound Syrup of Squill.

Tinctura Scillæ, U. S.—Tincture of Squill.

DIGITALIS, U. S.—Digitalis. (*Foxglove.*)—The leaves of *Digitalis purpurea*, collected from plants of the second year's growth.

Digitalis has been the subject of exhaustive investigation. The principle digitalin was at one time considered to be an alkaloid. It is, as usually seen, a mixture of digitoxin and other neutral principles. Digitoxin is converted into *toxiresin* by the action of diluted acids and heat.

Abstractum Digitalis, U. S.—Abstract of Digitalis.

Infusum Digitalis, U. S.—Infusion of Digitalis.

Extractum Digitalis Fluidum, U. S.—Fluid Extract of Digitalis.

Extractum Digitalis, U. S.—Extract of Digitalis.

Tinctura Digitalis, U. S.—Tincture of Digitalis.

VIOLA TRICOLOR, U. S.—Viola Tricolor. (*Pansy.*)—The wild-grown, flowering herb of *Viola tricolor* yields a bitter principle, resin, salicylic acid, mucilage, sugar, etc.

AZEDARACH, U. S.—Azedarach.—The bark of the root of *Melia*

azedarach contains a resinous principle, which is soluble in alcohol, ether and chloroform.

SPIGELIA, U. S.—Spigelia. (*Pinkroot.*)—The rhizome and rootlets of *Spigelia marilandica* contain a bitter principle, resin and a trace of volatile oil, with tannin and wax.

Extractum Spigeliæ Fluidum, U. S.—Fluid Extract of Spigelia.

BRAYERA, U. S.—Brayera. (*Koosso.*) The female inflorescence of *Brayera anthelmintica* contains a bitter resinous principle, *kosin*, $C_{31}H_{38}O_{10}$, about 24 per cent. of tannin, gum, sugar, etc.

Infusum Brayeræ, U. S.—Infusion of Brayera.

Extractum Brayeræ Fluidum, U. S.—Fluid extract of Brayera.

SANTONICA, U. S.—Santonica. (*Levant Wormseed.*)—The unexpanded flower-heads of *Artemisia maritima*, var. *Stechmanniana*, contain about 2 per cent. of *santonin*, resin, volatile oil, gum, etc.

SANTONINUM, U. S.—Santonin. $C_{15}H_{18}O_3$; 246.—A neutral principle prepared from santonica.

It should be kept in dark, amber-colored vials, and should not be exposed to light.

Description.—Santonin occurs in colorless, shining, flattened, prismatic crystals, not altered by exposure to air, but turning yellow on exposure to light; odorless; nearly tasteless when first placed in the mouth, but afterward bitter; neutral reaction.

Preparation.—Santonin may be made by exhausting santonica mixed with lime with diluted alcohol, distilling off the alcohol and adding acetic acid to the residue. The precipitated santonin is purified by dissolving it in alcohol, treating with animal charcoal, and crystallizing.

PICROTOXINUM, U. S.—Picrotoxin. $C_{30}H_{34}O_{13}$; 182.—A neutral principle prepared from the seeds of *Anamirta paniculata*, occurring in the form of colorless, flexible, shining, prismatic crystals, permanent in the air; odorless; very bitter taste; neutral reaction.

Preparation.—Picrotoxin is made from the kernel of cocculus indicus by treating an aqueous extract, which has been triturated with magnesia, with hot alcohol; the solution is evaporated, and the crystalline mass purified by recrystallization, after decolorizing with animal charcoal.

ERGOTA, U. S.—Ergot. (*Ergot of Rye.*)—The sclerotium of *Claviceps purpurea*, replacing the grain of *Secale cereale*.

Ergot should be preserved in a dry place, and should not be kept longer than a year.

Ergot owes its activity to *sclerotic acid*, *sclererythrin*, *scleromucin*, *sclerotiodin* and *picrosclerotin*; there is also present *scleroxanthin* and *sclerocrystallin*, with 25 per cent. of fixed oil, mycose, and protein compounds.

Extractum Ergotæ Fluidum, U. S.—Fluid Extract of Ergot.

Extractum Ergotæ, U. S.—Extract of Ergot.

Vinum Ergotæ, U. S.—Wine of Ergot.

USTILAGO, U. S.—Ustilago. (*Corn Smut.*)—*Ustilago maydis*, grown upon *Zea Mays*.

Ustilago should be preserved in a dry place, and should not be kept longer than a year.

Ustilago contains a principle analogous to sclerotic acid, resin, mucilage sugar, gum, etc.

GOSSYPII RADICIS CORTEX, U. S.—Cotton Root Bark.—The bark of the root of *Gossypium herbaceum* and of other species of *gossypium* contains a yellow resin, which becomes red upon exposure to air, fixed oil, tannin, starch, sugar, etc.

Extractum Gossypii Radicis Fluidum, U. S.—Fluid Extract of Cotton Root.

CROCUS, U. S.—Saffron.—The stigmas of *Crocus sativus* contain *polychroit*, $C_{48}H_{60}O_{18}$, a glucoside, which splits into *crocin* and glucose, volatile oil, wax, fixed oil, protein compounds, sugar, wax, etc.

Tinctura Croci, U. S.—Tincture of Saffron.

SANTALUM RUBRUM, U. S.—Red Saunders.—The wood of *Pterocarpus santalinus* contains *santalic acid*, a resinous substance, *pterocarpin* and *santol*.

RHUS TOXICODENDRON, U. S.—Rhus Toxicodendron. (*Toxicodendron, Pharm. 1870. Poison Ivy.*)—The fresh leaves of *Rhus toxicodendron* and *Rhus radicans* contain *toxicodendric acid*, fixed oil, tannin, mucilage, wax, etc.

Drugs Containing Saponinoid Principles, with their Preparations.

QUILLAIA, U. S.—Quillaia. (*Soap Bark.*)—The bark of *Quillaia saponaria* owes its action to a peculiar principle, *saponin*, $C_{32}H_{54}O_{18}$, a glucoside, splitting, upon heating with dilute acid, into *sapogenin* and sugar.

SARSAPARILLA, U. S.—Sarsaparilla.—The root of *Smilax officinalis, Smilax medica* and of other undetermined species of *Smilax*, contains a glucoside analogous to, if not identical with, saponin, termed *parillin*. When boiled with dilute acids, it splits into *parigenin* and grape sugar.

Decoctum Sarsaparillæ Compositum, U. S.—Compound Decoction of Sarsaparilla.

Extractum Sarsaparillæ, Fluidum, U. S.—Fluid Extract of Sarsaparilla.

Extractum Sarsaparillæ Compositum Fluidum, U. S.—Compound Fluid Extract of Sarsaparilla.

Syrupus Sarsaparillæ Compositus, U. S.—Compound Syrup of Sarsaparilla.

SENEGA, U. S.—Senega.—The root of *Polygala senega*. Senega contains *polygalic acid* (sometimes called *senegin*), fixed oil, pectose, etc. Polygalic acid is analogous to, if not identical with, saponin. Liquid preparations of senega are very apt to gelatinize, owing to the presence of pectin; this is obviated by using water of ammonia or other alkali, to dissolve it.

Abstractum Senegæ, U. S.—Abstract of Senega.

Extractum Senegæ Fluidum, U. S.—Fluid Extract of Senega.

Syrupus Senegæ, U. S.—Syrup of Senega.

CAULOPHYLLUM, U. S.—Caulophyllum. (*Blue Cohosh.*)—The rhizome and rootlets of *Caulophyllum thalictroides* contain *saponin*, associated with resin, starch, albumen, coloring matter, extractive, etc.

Drugs Containing Cathartic Principles, and their Preparations.

SENNA, U. S. –Senna.—The leaflets of *Cassia acutifolia* (Alexandria Senna), and of *Cassia elongata* (India Senna), contain cathartic acid, which, under the influence of dilute acids and heat, splits into cathartogenic acid and glucose; there are also present phæoretin, sennocrol, cathartomannit, crysophan, mucilage, etc. Cathartic acid is believed to be the chief purgative principle, although several of the others possess cathartic properties.

Extractum Sennæ Fluidum, U. S.—Fluid Extract of Senna.

Infusum Sennæ Compositum, U. S.—Compound Infusion of Senna.

Syrupus Sennæ, U. S.—Syrup of Senna.

Confectio Sennæ, U. S.—Confection of Senna.

TAMARINDUS, U. S. – Tamarind.—The preserved pulp of the fruit of *Tamarindus indica.*

CASSIA FISTULA, U. S.—Cassia Fistula. (*Purging Cassia.*)—The fruit of *Cassia fistula* yields about 25 per cent. of pulp, which contains pectin, sugar, albuminous principles, salts, etc.

FICUS, U. S.—**Fig.**—The fleshy receptacle of *Ficus carica*, bearing fruit upon its inner surface.

PRUNUM, U. S.—**Prune.**—The fruit of *Prunus domestica* contains sugar, malic acid, pectin, salts, etc.

RHEUM, U. S.—Rhubarb.—The root of *Rheum officinale*, and of other undetermined species of *rheum.* Rhubarb contains four resins, which are cathartic in their properties—*erythroretin*, *phæoretin*, *aporetin*, *emodin.* There are also present chrysophan and chrysophanic acid, both yellow, the former yielding the latter and glucose when treated with diluted acids. The astringent properties of rhubarb are due to *rheotannic acid*, $C_{26}H_{26}O_{14}$; *rheumic acid*, $C_{20}H_{16}O_9$, and calcium oxalate are also present.

Extractum Rhei, U. S.—Extract of Rhubarb.

Extractum Rhei Fluidum, U. S.—Fluid Extract of Rhubarb.

Tinctura Rhei, U. S.—Tincture of Rhubarb.

Tinctura Rhei Aromatica, U. S.—Aromatic Tincture of Rhubarb.

Tinctura Rhei Dulcis, U. S.—Sweet Tincture of Rhubarb.

Syrupus Rhei, U. S.—Syrup of Rhubarb.

Syrupus Rhei Aromaticus, U. S.—Aromatic Syrup of Rhubarb.

Vinum Rhei, U. S.—Wine of Rhubarb.

Mistura Rhei et Sodæ, U. S.—Mixture of Rhubarb and Soda.

Pulvis Rhei Compositus, U. S.—Compound Powder of Rhubarb.

Pilulæ Rhei, U. S.—Pills of Rhubarb.

Pilulæ Rhei Compositæ, U. S.—Compound Pills of Rhubarb.

CHRYSAROBINUM, U. S.—Chrysarobin.—A mixture of proximate principles (commonly misnamed Chrysophanic Acid), extracted from goa powder, a substance found deposited in the wood of the trunk of *Andira araroba.* Chrysarobin is a pale, orange-yellow, crystalline powder, permanent in the air; odorless and tasteless; almost insoluble in water, only slightly soluble in alcohol, readily soluble in ether and boiling benzol.

Unguentum Chrysarobini, U. S.—Chrysarobin Ointment.

KAMALA, U. S.—Kamala. (*Rottlera, Pharm. 1870.*)—The glands and hairs from the capsules of *Mallotus philippinensis* contain *rottlerin*,

$C_{22}H_{20}O_6$, nearly 75 per cent. of resins soluble in alcohol, coloring matter, etc.

CAMBOGIA, U. S.—Gamboge. (*Gambogia, Pharm. 1870.*)—A gum-resin obtained from *Garcinia Hanburii;* contains about 75 per cent. of resin called *gambogic acid.*

JALAPA, U. S.—Jalap.—The tuberous root of *Exogonium purga* contains from 12 to 20 per cent. of resin, the greater part of which is *convolvulin*, $C_{62}H_{100}O_{32}$, a glucoside, insoluble in ether; there are also present gum, sugar, starch, etc.

Abstractum Jalapæ, U. S.—Abstract of Jalap.

Pulvis Jalapæ Compositus, U. S.—Compound Powder of Jalap.

Resinæ Jalapæ, U. S.—Resin of Jalap.

SCAMMONIUM, U. S.—Scammony.—A resinous exudation from the root of *Convolvulus scammonia;* contains from 80 to 90 per cent of resin having cathartic properties, called *scammonin*, $C_{34}H_{56}O_{16}$; this is identical with the jalapin obtained from Ipomæa orizabensis.

Resina Scammonii, U. S.—Resin of Scammony.

PODOPHYLLUM, U. S.—Podophyllum. (*May Apple.*)—The rhizome and rootlets of *Podophyllum peltatum* contain *picropodophyllin*, *podophyllotoxin* and *podophyllinic acid.*

Abstractum Podophylli, U. S.—Abstract of Podophyllum.

Extractum Podophylli, U. S.—Extract of Podophyllum.

Extractum Podophylli Fluidum, U. S.—Fluid Extract of Podophyllum.

Resina Podophylli, U. S.—Resin of Podophyllum.

LEPTANDRA, U. S.—Leptandra. (*Culver's Root.*)—The rhizome and rootlets of *Leptandra virginica* contain a crystalline principle, *leptandrin*, resin, tannin, saponin, gum, mannit, etc.

Extractum Leptandræ, U. S.—Extract of Leptandra.

Extractum Leptandræ Fluidum, U. S.—Fluid Extract of Leptandra.

FRANGULA, U. S.—Frangula.—The bark of *Rhamnus frangula*, collected at least one year before being used, contains *frangulin*, $C_{20}H_{20}O_{10}$, sometimes called *rhamnoxanthin*, and emodin; both are glucosides.

Extractum Frangulæ Fluidum, U. S.—Fluid Extract of Frangula.

RUMEX U. S.—Rumex. (*Yellow Dock.*)—The root of *Rumex crispus*, and of other species of *rumex*, contains chrysophanic acid (rumicin, lapathin), mucilage, tannin, starch, calcium oxalate, gum, coloring matter, etc.

Extractum Rumicis Fluidum, U. S.—Fluid Extract of Rumex.

JUGLANS, U. S.—Juglans. (*Butternut*)—The inner bark of the root of *Juglans cinerea*, collected in autumn. It contains *mucin*, $C_{36}H_{12}O_{10}$, fixed oil, volatile oil, tannin, etc.

Extractum Juglandis, U. S.—Extract of Juglans.

EUONYMUS, U. S.—Euonymus. (*Wahoo.*)—The bark of *Euonymus atropurpureus* contains resins, a bitter principle called *euonymin, euonic acid*, starch, asparagin and pectin.

Extractum Euonymi, U. S.—Extract of Euonymus.

ALOE, U. S.—Aloes. (*Aloe Socotrina, Pharm. 1870.*)—The inspissated juice of the leaves of *Aloe socotrina* contains *aloin*, a trace of volatile oil, and a substance which has been improperly called resin. The aloin

present in officinal aloes is *socaloin*, $C_{15}H_{16}O_7$. This may be distinguished from nataloin and barbaloin by Histed's Test.*

Extractum Aloes Aquosum, U. S.—Aqueous Extract of Aloes.

Aloe Purificata, U. S.—Purified Aloes.

ALOE PURIFICATA, U. S.—Purified Aloes.—It occurs in irregular, brittle pieces, of a dull-brown or reddish-brown color, and having the peculiar odor of Socotrine aloes. It is purified by melting, adding alcohol, to reduce its consistency, and straining off the impurities, sand, earth, chips, etc., evaporating, and, when cool, breaking the brittle mass into pieces of a convenient size.

Tinctura Aloes, U. S.—Tincture of Aloes.

Tinctura Aloes et Myrrhæ, U. S.—Tincture of Aloes and Myrrh.

Vinum Aloes, U. S.—Wine of Aloes.

Pilulæ Aloes, U. S.—Pills of Aloes.

Pilulæ Aloes et Asafetidæ, U. S.—Pills of Aloes and Asafetida.

Pilulæ Aloes et Ferri, U. S.—Pills of Aloes and Iron.

Pilulæ Aloes et Mastiches, U. S.—Pills of Aloes and Mastich.

Pilulæ Aloes et Myrrhæ, U. S.—Pills of Aloes and Myrrh.

COLOCYNTHIS, U. S.—Colocynth.—The fruit of *Citrullus colocynthis*, deprived of its rind, contains *colocynthin*, *colocynthitin*, gum, resin, etc. Colocynthin is a very bitter glucoside, splitting, under the action of diluted acids, into colocynthein and grape sugar.

Extractum Colocynthidis, U. S.—Extract of Colocynth.

Extractum Colocynthidis Compositum, U. S.—Compound Extract of Colocynth.

ELATERINUM, U. S.—Elaterin. $C_{20}H_{28}O_5$; 348.—Small, colorless, shining, hexagonal scales or prisms, permanent in the air; odorless; having a bitter, somewhat acrid taste, and a neutral reaction. Prepared from elaterium, a sediment deposited by the juice of the fruit of the squirting cucumber, *Ecballium elaterium*, by exhausting with alcohol, evaporating to the consistency of a thin oil, and throwing the residue, while yet warm, into a weak boiling solution of potassa, by which the green resin is held in solution, and the elaterin crystallizes out when the liquor cools. Or it may be made by exhausting elaterium with chloroform, and precipitating the elaterin from the chloroform solution by ether.

Trituratio Elaterini, U. S.—Trituration of Elaterin.

BRYONIA, U. S.—Bryonia. (*Bryony.*)—The root of *Bryonia alba*, and of *Bryonia dioica*, contains bryonin, a bitter glucoside, soluble in alcohol and in water; starch, sugar, resin, etc.

Tinctura Bryoniæ, U. S.—Tincture of Bryonia.

Drugs Containing Astringent Principles, and their Preparations.

GALLA, U. S.—Nutgall.—Excrescences on *Quercus lusitanica*, var. *infectoria*, caused by the punctures and deposited ova of *Cynips Gallæ tinctoriæ*. Nutgall contains about 50 per cent. of tannin, 2 per cent. of gallic acid, sugar, gum, resin and starch.

Tinctura Gallæ, U. S.—Tincture of Nutgall.

Unguentum Gallæ, U. S.—Nutgall Ointment.

* See Remington's "Practice of Pharmacy."

ACIDUM TANNICUM, U. S.—**Tannic Acid.** $C_{14}H_{10}O_9$ (chiefly); 322.—Light-yellowish scales, permanent in the air; faint, peculiar odor; strongly astringent taste; acid reaction. Prepared by exposing nutgall, in fine powder, to a damp atmosphere for twenty-four hours, making into a paste with ether, setting the paste aside, covered closely, for six hours, then expressing it powerfully between tinned plates, so as to obtain the liquid portion. The resulting cake is again made into a paste with ether and water, and expressed as before, after which the liquids are mixed and evaporated spontaneously to a syrupy consistence, then spread on glass or tin plates, and dried quickly in a drying closet. Water and ether form a soluble compound with the tannic acid, and the expression separates it from the paste, after which the ether and water are driven off by the heat. Tannic acid, chemically, is an anhydride of gallic acid:—

$$\underset{\text{Gallic Acid.}}{2C_7H_6O_5} - \underset{\text{Water.}}{H_2O} = \underset{\text{Tannic Acid.}}{C_{14}H_{10}O_9}.$$

Unguentum Acidi Tannici, U. S.—Ointment of Tannic Acid.

Trochisci Acidi Tannici, U. S.—Troches of Tannic Acid.

ACIDUM GALLICUM, U. S.—**Gallic Acid.** $HC_7H_5O_5.H_2O$; 188.—A nearly or quite colorless solid, crystallizing from water in long, silky needles or triclinic prisms, permanent in the air; odorless; astringent and slightly acidulous taste; acid reaction. Prepared by macerating nutgalls (powdered and made into a paste) with water, for a month, expressing, rejecting the expressed liquor, boiling the residue in water, filtering, while hot, through animal charcoal, and crystallizing. The tannic acid of the galls is converted into gallic acid through the continued maceration with water.

$$\underset{\text{Tannic Acid.}}{C_{14}H_{10}O_9} + \underset{\text{Water.}}{H_2O} = \underset{\text{Gallic Acid.}}{2C_7H_6O_5}.$$

Pyrogallic Acid.—When gallic acid is sublimed, the heat converts it into pyrogallic acid and carbon dioxide:—

$$\underset{\text{Gallic Acid.}}{C_7H_6O_5} = \underset{\text{Pyrogallic Acid.}}{C_6H_6O_3} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

Unguentum Acidi Gallici, U. S.—Ointment of Gallic Acid.

CATECHU, U. S.—**Catechu.**—An extract prepared from the wood of *Acacia catechu* contains catechutannic acid, a peculiar form of tannin, which is insoluble in ether, and turns greenish-black with ferric salts. *Catechin* and *catechol* are also present. Owing to the decomposition of the tannic acid, the liquid preparations often gelatinize.

Tinctura Catechu Composita, U. S.—Compound Tincture of Catechu.

Trochisci Catechu, U. S.—Troches of Catechu.

KINO, U. S.—**Kino.**—The inspissated juice of *Pterocarpus marsupium* contains kino-tannic acid, pyrocatechin, kino red, kinoin, gum, etc. Owing to the decomposition of the kino-tannic acid, the liquid preparations frequently gelatinize.

Tinctura Kino, U. S.—Tincture of Kino.

HÆMATOXYLON, U. S.—**Hæmatoxylon.** (*Logwood.*)—The heart-wood of *Hæmatoxylon campechianum* contains a colorless, sweet principle, *hæmatoxylin* $C_{16}H_{14}O_6$, which is reddened upon exposure to

light, and turned blackish-purple upon contact with alkalies, yielding *hæmatëin*, $C_{16}H_{12}O_6.H_2O$; it also contains tannin, resin, etc.

Extractum Hæmatoxyli, U. S.—Extract of Hæmatoxylon.

KRAMERIA, U. S.—Krameria. (*Rhatany*).—The root of *Krameria triandra*, and of *Krameria tomentosa*, contains about 18 per cent. of kramero-tannic acid, starch, gum, rhatannic red, etc.

Extractum Krameriæ, U. S.—Extract of Krameria.

Extractum Krameriæ Fluidum, U. S.—Fluid Extract of Krameria.

Tinctura Krameriæ, U. S.—Tincture of Krameria.

QUERCUS ALBA, U. S.—White Oak.—The bark of *Quercus alba* contains about 10 per cent. of tannic acid, with pectin, resin, and brownish-red coloring-matter.

ROSA GALLICA, U. S.—Red Rose.—The petals of *Rosa gallica*, collected before expanding. It contains *quercitrin* and *quercitannic acid*; the pale red coloring matter is made bright red by the addition of sulphuric acid.

Extractum Rosæ Fluidum, U. S.—Fluid Extract of Rose.

Mel Rosæ, U. S.—Honey of Rose.

Confectio Rosæ, U. S.—Confection of Rose.

ROSA CENTIFOLIA, U. S.—Pale Rose.—The petals of *Rosa centifolia* contain a little tannin, volatile oil, sugar, mucilage, etc.

Aqua Rosæ, U. S.—Rose Water.

OLEUM ROSÆ, U. S.—Oil of Rose.—A volatile oil distilled from the fresh flowers of *Rosa damascena*. It is a pale-yellowish, transparent liquid, having a strong odor of rose; a sweetish, rather mild taste, and a slightly acid reaction; sp. gr. about 0.860.

RHUS GLABRA, U. S.—Rhus Glabra.—The fruit of *Rhus Glabra*.

RUBUS, U. S.—Rubra. (*Blackberry.*)—The bark of the root of *Rubus villosus*, *Rubus canadensis*, and *Rubus trivialis*, owes its astringent properties to tannic acid.

Extractum Rubi Fluidum, U. S.—Fluid Extract of Rubus.

GERANIUM, U. S.—Geranium. (*Cranesbill.*)—The rhizome of *Geranium maculatum* contains about 15 per cent. of tannic acid, with brownish-red coloring matter, starch, sugar, pectin, etc.

Extractum Geranii Fluidum, U. S.—Fluid Extract of Geranium.

HAMAMELIS, U. S.—Hamamelis. (*Witchhazel.*)—The leaves of *Hamamelis virginica*, collected in autumn, contain tannic acid, chlorophyll, bitter principle, mucilage, etc.

Extractum Hamamelidis Fluidum, U. S.—Fluid Extract of Hamamelis.

CHIMAPHILA, U. S.—Chimaphila. (*Pipsissewa.*)—The leaves of *Chimaphila umbellata* contain about 5 per cent. of tannic acid, with *chimaphilin*, *ericolin*, *arbutin*, *ursen*, sugar, gum, etc.

Extractum Chimaphila Fluidum, U. S.—Fluid Extract of Chimaphila.

UVA URSI, U. S.—Uva Ursi. (*Bearberry.*)—The leaves of *Arctostaphylos uva ursi* contain about 6 per cent. of tannic acid, with gallic acid, *ursen*, *arbutin*, *ericolin*, gum, resin, coloring matter, etc.

Extractum Uvæ Ursi Fluidum, U. S.—Fluid Extract of Uva Ursi.

CASTANEA, U. S.—Castanea. (*Chestnut.*)—The leaves of *Cas-*

tanea vesca, collected in September or October, while still green. Chestnut leaves contain tannic acid, mucilage, etc.

Extractum Castaneæ Fluidum, U. S.—Fluid Extract of Castanea.

SALVIA, U. S.—Salvia. (*Sage.*)—The leaves of *Salvia officinalis.*

ALKALOIDS.

Into what two General Divisions are Alkaloids Divided Chemically? AMIDES—Composed of C H N and O; AMINES—Composed of C H and N (oxygen wanting).

What is the Source of Alkaloids? They are found in both the animal and vegetable kingdoms.

What are their Distinctive Features? First, they all contain N. The non-volatile alkaloids (amides) are solid, the volatile alkaloids (amines) are liquid. Second, they restore the color of reddened litmus, combine with acids to form salts, and are precipitated from their saline solutions by alkalies. Third, they are generally the active principles of the plants in which they reside, are mostly poisonous, and have a bitter, acrid or pungent taste. Fourth, they are mostly crystallizable and colorless, insoluble in H_2O, soluble in alcohol, chloroform, benzin, benzol, and some in ether. Their salts, however, are mostly soluble in H_2O, less so in alcohol; insoluble in chloroform, ether, benzin and benzol. Fifth, they are mostly precipitated by one or more of the following reagents: *Potassio-mercuric iodide*, *auric chloride*, *tannic acid*, *phospho-molybdic acid* and *picric acid.*

What Nomenclature has been adopted for the Alkaloids? The last syllable should terminate in *ine*; the Latin termination is *ina*; the names of neutral principles and glucosides end in *in*.

OPIUM, U. S.—Opium.—The concrete, milky exudation obtained in Asia Minor by incising the unripe capsules of *Papaver somniferum*, containing, in its normal moist condition, not less than 9 per cent. of morphine when assayed, and when in dry powder, not less than 12 nor more than 16 per cent. of morphine.

What two Acids are found in Opium combined with the Alkaloids? Meconic and lactic acids.

How many Alkaloids does Opium contain? Nineteen, of which the most important is morphine.

OPIUM DENARCOTISATUM, U. S.—Denarcotized Opium.—Opium from which the narcotine has been extracted with stronger ether, and mixing it with sugar of milk, and containing 14 per cent. of morphine,

Extractum Opii, U. S.—Extract of Opium.

Pulvis Opii, U. S.—Powdered Opium. In No. 50 powder, 8 grains represent about 10 grains of opium.

Tinctura Opii, U. S.—Tincture of Opium.

Tinctura Opii Deodorata, U. S.—Deodorized Tincture of Opium. Made by separating out the narcotine and odorous principles with ether.

Acetum Opii, U. S.—Vinegar of Opium.

Tinctura Opii Camphorata, U. S.—Camphorated Tincture of Opium (Paregoric.)

Vinum Opii, U. S.—Wine of Opium.

Pilulæ Opii, U. S.—Pills of Opium.

Pulvis Ipecacuanhæ et Opii, U. S.—Powder of Ipecac and Opium.

Emplastrum Opii, U. S.—Opium Plaster.

Trochisci Glycyrrhizæ et Opii, U. S.—Troches of Glycyrrhiza and Opium.

MORPHINA, U. S.—Morphine. $C_{17}H_{19}NO_3.H_2O$.—Colorless or white, shining, prismatic crystals, or a crystalline powder, permanent in the air; odorless; bitter taste; alkaline reaction. Prepared from an aqueous solution of opium containing the alkaloid in combination with meconic and lactic acids, by treating it with alcohol and water of ammonia—the former retaining the coloring matter, caoutchouc, resins, etc., in solution, while the latter sets free the morphine, by combining with the natural acids. The alkaloid is then purified by dissolving in boiling alcohol, filtering through animal charcoal, and crystallizing.

MORPHINÆ ACETAS, U. S.—Acetate of Morphine. (*Morphiæ Acetas, Pharm. 1870.*) $C_{17}H_{19}NO_3.HC_2H_3O_2.3H_2O$; 399.—A white or yellowish-white, crystalline or amorphous powder, slowly losing acetic acid when kept for some time and exposed to the air; having a faintly acetous odor, a bitter taste, and a neutral or faintly alkaline reaction. Prepared by acting on morphine with acetic acid.

MORPHINÆ HYDROCHLORAS, U. S.—Hydrochlorate of Morphine. $C_{17}H_{19}NO_3.HCl.3H_2O$; 375.4.—White, feathery, flexible, acicular crystals, of a silky lustre, permanent in the air; odorless; bitter taste; neutral reaction. Made by acting on morphine with hydrochloric acid.

MORPHINÆ SULPHAS, U. S.—Sulphate of Morphine. $(C_{17}H_{19}NO_3)_2.H_2SO_4.5H_2O$; 758.—White, feathery, acicular crystals, of a silky lustre, permanent in the air; odorless; bitter taste; neutral reaction. Prepared by acting on morphine with sulphuric acid.

Pulvis Morphinæ Compositus, U. S.—Compound Morphine Powder.

Trochisci Morphinæ et Ipecacuanhæ, U. S.—Troches of Morphine and Ipecac.

CODEINA, U. S.—Codeine. (*Codeia.*) $C_{18}H_{21}NO_3.H_2O$; 317.—An alkaloid prepared from opium, occurring in the form of white or yellowish-white, more or less translucent, rhombic prisms, somewhat efflorescent in warm air; odorless; slightly bitter taste; alkaline reaction. Prepared by precipitating the hydrochlorates of morphine and codeine with ammonia, codeine remaining in solution, and afterward obtained by evaporation, crystallization, and purifying by dissolving in hot ether, and evaporating spontaneously.

APOMORPHINÆ HYDROCHLORAS, U. S.—Hydrochlorate of Apomorphine. $C_{17}H_{17}NO_2HCl$; 303.4.—A salt of an alkaloid of opium, occurring in the form of minute, colorless or grayish-white, shining crystals, turning greenish on exposure to light and air; odorless; bitter taste; neutral or faintly acid reaction. Prepared by heating morphine in a closed tube, with a great excess of hydrochloric acid, for two or three hours, to the temperature of 140°–150°C. (284°–302° F.), dissolving the contents of the tube in water, adding an excess of $NaHCO_3$, and exhausting the precipitate with ether or chloroform; the addition of HCl now results in crystals of the salt. The rationale of the process is one of dehydration; the morphine parts with one molecule of water.

CINCHONA, U. S.—Cinchona.—The bark of any species of *Cinchona*, containing at least 3 per cent. of its peculiar alkaloids.

CINCHONA FLAVA, U. S.—Yellow Cinchona. (*Calisaya Bark.*)—The bark of the trunk of *Cinchona calisaya*, containing at least 2 per cent. of quinine.

CINCHONA RUBRA, U. S.—Red Cinchona. (*Red Bark.*)—The bark of the trunk of *Cinchona succirubra*, containing at least 2 per cent. of quinine.

Cinchona barks are assayed, first, for total alkaloids; second, for quinine, by a process directed in the U. S. P. (which see). About twenty alkaloids have been discovered in cinchona bark. Some of these are found only in one kind of bark; some are doubtless, "split products" (alkaloids not existing naturally in the bark, but the result of the action of chemical agents upon it.) The most important alkaloids found in cinchona are *quinine*, *quinidine*, *cinchonine* and *cinchonidine*. The acids present are *kinic* or *quinic*, *cinchotannic* and *kinovic* or *quinovic*. The neutral principle is *kinovin*, or *quinovin*; *cinchonic red*, volatile oil and red and yellow coloring matters are also present.

Extractum Cinchonæ, U. S.—Extract of Cinchona.

Extractum Cinchonæ Fluidum, U. S.—Fluid Extract of Cinchonæ.

Tinctura Cinchonæ, U. S.—Tincture of Cinchona.

Tinctura Cinchonæ Composita, U. S.—Compound Tincture of Cinchona.

QUININA, U. S.—Quinine. $C_{20}H_{24}N_2O_2.3H_2O$ (crystallized); 378.—Quinine is an alkaloid from cinchona, occurring in the form of a white, flaky, amorphous, or minutely crystalline powder, permanent in the air. It is odorless, has a very bitter taste and alkaline reaction. Prepared by adding to the acid solution of the sulphate ammonia water or solution of soda, which precipitates the alkaloid. As quinine is soluble in alkalies, carefully avoid excess.

QUININÆ SULPHAS, U. S.—Sulphate of Quinine. (*Quiniæ Sulphas, Pharm. 1870.*) $(C_{20}H_{24}N_2O_2)_2H_2SO_4.7H_2O$; 872.—Snow-white, loose, filiform crystals, fragile and somewhat flexible, making a very light and easily compressible mass; lustreless, from superficial efflorescence, after standing in the air, and losing most of its water of crystallization on long exposure; odorless; persistent, very bitter taste; neutral reaction. Prepared by treating yellow cinchona bark with hydrochloric acid, which forms, with the alkaloids, soluble hydrochlorates; decomposing with lime, which precipitates the alkaloid; dissolving out the alkaloid from the excess of lime with boiling alcohol; evaporating; acidulating with sulphuric acid, which forms the sulphate; then purifying with animal charcoal, and crystallizing.

QUININÆ BISULPHAS, U. S.—Bisulphate of Quinine. $C_{20}H_{24}N_2O_2H_2SO_4.7H_2O$; 548.—Clear, colorless, orthorhombic crystals or small needles, efflorescing and becoming opaque on exposure to air; odorless; very bitter taste; strongly acid reaction. Prepared by acting on quinine sulphate by sulphuric acid. The bisulphate of quinine contains 13 per cent. less alkaloid than the sulphate.

QUININÆ HYDROCHLORAS, U. S.—Hydrochlorate of Quinine. $C_{20}H_{24}N_2O_2HCl.2H_2O$; 396.4.—White, lustrous needles, forming tufts, permanent in ordinary air, but readily efflorescing at a gentle

heat; odorless, very bitter taste; neutral or faintly alkaline reaction. Prepared by double decomposition between quinine sulphate and barium chloride, or by dissolving the alkaloid in dilute HCl, evaporating and crystallizing.

QUININÆ HYDROBROMAS, U. S. — **Hydrobromate of Quinine.** $C_{20}H_{24}N_2O_2HBr.2H_2O$; 440.8.—Colorless, lustrous needles, permanent in ordinary air, but readily efflorescing at a gentle heat; odorless; very bitter taste; neutral or slightly alkaline reaction. Prepared by decomposing quinine sulphate in alcohol, with potassium bromide, in water. K_2SO_4 crystallizes out, and the hydrobromate may be obtained by evaporating and crystallizing. Quinine hydrobromate may also be made by double decomposition between quinine sulphate and barium bromide, or by dissolving the alkaloids in hot dilute HBr.

QUININÆ VALERIANAS, U. S.—**Valerianate of Quinine.** $C_{20}H_{24}N_2O_2C_5H_{10}O_2.H_2O$; 444.—White or nearly white, pearly, lustrous, triclinic crystals, permanent in the air and slightly soluble in ether; slight odor of valerianic acid; bitter taste; neutral reaction. Prepared by decomposing the sulphate by AmHO, and combining it with valerianic acid. (Hot solutions are used and the valerianate crystallizes on cooling.)

QUINIDINÆ SULPHAS, U. S. — **Sulphate of Quinidine.** $(C_{20}H_{24}N_2O_2)_2H_2SO_4.2H_2O$; 728.—A salt of an alkaloid of cinchona, obtained from the mother-liquors obtained after the crystallization of quinine, occurring in the form of white, silky needles, permanent in the air; odorless; very bitter taste; neutral or faintly alkaline reaction, and differing from quinine in being dextrogyre (quinine is lævogyre) and being almost insoluble in ether.

CINCHONINA, U. S.—**Cinchonine.** (*Cinchonia.*) $C_{20}H_{24}N_2O$; 308.—An alkaloid of cinchona, which may be obtained from the mother-waters of quinine sulphate by diluting them with water, precipitating with AmHO, washing and drying, and then dissolving in boiling alcohol, which deposits the cinchonine in a crystalline form upon cooling. It may be purified still further by re-crystallization. It occurs in the form of white, somewhat lustrous prisms or needles, permanent in the air; odorless; at first nearly tasteless, but developing a bitter after-taste; alkaline reaction.

CINCHONINÆ SULPHAS, U. S.—**Sulphate of Cinchonine.** (*Cinchoniæ. Pharm. 1870.*) $(C_{20}H_{24}N_2O)_2H_2SO_4.2H_2O$; 750.—Hard, white, shining prisms of the clino-rhombic system, permanent in the air; odorless; very bitter taste; neutral or faintly alkaline reaction. Prepared from quinine mother-liquors by precipitating with soda, and converting into a sulphate by H_2SO_4, decolorizing and crystallizing.

CINCHONIDINÆ SULPHAS, U. S.—**Sulphate of Cinchonidine.** $(C_{20}H_{24}N_2O)_2H_2SO_4.3H_2O$; 768.—A salt of an alkaloid of cinchona, obtained from quinine mother-liquors by a fractional crystallization, and occurring in the form of white, silky, lustrous needles, or thin, quadratic prisms; odorless; very bitter taste; neutral or faintly alkaline reaction.

CHINOIDINUM, U. S.—**Chinoidin.** (*Quinoidin.*)—A mixture of alkaloids, mostly amorphous, obtained as a by-product in the manufacture of the crystallizable alkaloids from cinchona, occurring in the form of a brownish-black or almost black solid, breaking, when cold, with a resinous, shining fracture, becoming plastic when warm; odorless; bitter taste;

alkaline reaction; and consisting largely of *quinicine* and *cinchonicine*, alkaloids isomeric with quinine and cinchonine, and produced by the action of heat upon the latter. Chinoidin is prepared as follows: When the quinine mother-liquids are precipitated with soda, an amorphous resinous mass separates. This mass consists of the uncrystallizable alkaloids which have probably lost their power of crystallization, owing to the heat to which they have been subjected during evaporation.

NUX VOMICA, U. S.—Nux Vomica.—The seed of *Strychnos nux vomica*. It contains strychnine, brucine ($C_{23}H_{26}N_2O_4$), probably, igasurine, igasuric acid, protein compounds, gum, fixed oil, sugar, etc. It owes its activity principally to strychnine. Its officinal preparations are:—

Abstractum Nucis Vomicæ, U. S.—Abstract of Nux Vomica.

Extractum Nucis Vomicæ Fluidum, U. S.—Fluid Extract of Nux Vomica.

Tinctura Nucis Vomicæ, U. S.—Tincture of Nux Vomica.

IGNATIA, U. S.—Ignatia. (*Bean of St. Ignatius.*)—The seed of *Strychnos Ignatii*. It contains strychnine and brucine combined with igasuric acid, gum, resin, extractive, fixed oil, bassorin, etc. Its activity is principally due to strychnine, of which it yields a larger proportion than Nux Vomica.

Abstractum Ignatiæ, U. S.—Abstract of Ignatia.

Tinctura Ignatiæ, U. S.—Tincture of Ignatia.

STRYCHNINA, U. S.—Strychnine. $C_{21}H_{22}N_2O_2$; 334.—An alkaloid prepared from nux vomica or ignatia, and also occurring in other plants of the natural order *Loganiaceæ*, occurring in the form of colorless, octahedral or prismatic crystals, or a white, crystalline powder, permanent in the air; odorless; intensely bitter taste, which is still perceptible in a highly dilute (one in 700,000) solution; alkaline reaction. Prepared by treating nux vomica with hydrochloric acid, decomposing by lime, dissolving out from the excess of lime with boiling alcohol (the brucine having been previously removed by treatment with diluted alcohol), evaporating the alcoholic solution, acidulating with H_2SO_4, to form a sulphate, decolorizing and crystallizing, then dissolving the crystals and precipitating the alkaloid by AmHO.

STRYCHNINÆ SULPHAS, U. S.—Sulphate of Strychnine. (*Strychniæ Sulphas, Pharm. 1870.*) $(C_{21}H_{22}N_2O_2)_2H_2SO_4.7H_2O$; 892. —Colorless or white, shining, prismatic crystals, efflorescent in dry air; odorless; intensely bitter taste, which is still perceptible in a highly dilute (one in 700,000) solution; neutral reaction. Prepared during the process for making strychnine, and much more soluble than the latter.

GELSEMIUM, U. S.—Gelsemium. (*Yellow Jasmine.*)—The rhizome and rootlets of *Gelsemium sempervirens* contains *gelsemine*, $C_{11}H_{12}NO_2$, gelseminic acid, volatile oil, starch, resin, fat, coloring matter, etc.

Extractum Gelsemii Fluidum, U. S.—Fluid Extract of Gelsemium.

Tinctura Gelsemii, U. S.—Tincture of Gelsemium.

PHYSOSTIGMA, U. S.—Physostigma. (*Calabar Bean.*)—The seed of *Physostigma venenosum*, containing *physostigmine* or *eserine*, $C_{15}H_{21}N_3O_2$, an alkaloid, amorphous and without taste; also *calabarine*, an alkaloid derived from eserine; and a neutral principle, *physosterin*; also starch, protein compounds, mucilage, etc.

Extractum Physostigmatis, U. S.—Extract of Physostigma.

Tinctura Physostigmatis, U. S.—Tincture of Physostigma.

PHYSOSTIGMINÆ SALICYLAS, U. S.—**Salicylate of Physostigmine.** $C_{15}H_{21}N_3O_2C_7H_6O_3$; 413.—Colorless, shining, acicular, or short, columnar crystals, gradually turning red when long exposed to air and light; odorless; bitter taste; neutral reaction. Prepared by adding 2 p. of physostigmine to a solution of 1 p. of salicylic acid in 35 p. boiling distilled water, and allowing the salt to crystallize on cooling.

BELLADONNÆ FOLIA, U. S.—**Belladonna Leaves.**—The leaves of *Atropa belladonna*.

BELLADONNÆ RADIX, U. S.—**Belladonna Root.**—The root of *Atropa belladonna*. Belladonna owes its activity to *atropine*, $C_{17}H_{23}NO_3$, and a small quantity of *hyoscyamine*; it also contains *belladonine*. Officinal preparations of the leaves:—

Extractum Belladonnæ Alcoholicum, U. S.—Alcoholic Extract of Belladonna.

Tinctura Belladonnæ, U. S.—Tincture of Belladonna.

Unguentum Belladonnæ, U. S.—Belladonna Ointment.

Of the root:—

Abstractum Belladonnæ, U. S.—Abstract of Belladonna.

Extractum Belladonnæ Fluidum, U. S.—Fluid Extract of Belladonna.

Emplastrum Belladonnæ, U. S.—Belladonna Plaster.

Linimentum Belladonnæ, U. S.—Belladonna Liniment.

ATROPINA, U. S.—**Atropine.** (*Atropia, Pharm. 1870.*) $C_{17}H_{23}NO_3$; 289.—Colorless or white acicular crystals, permanent in the air; odorless; bitter and acrid taste; alkaline reaction. Prepared by treating a concentrated alcoholic tincture of the root with H_2SO_4, to convert the atropine into sulphate, distilling off the alcohol, adding water to the residuary liquid, filtering, to separate oil and resin, treating the filtrate with potassium hydrate and chloroform—the former to decompose the sulphate, and evaporating the latter, to obtain the alkaloid.

ATROPINÆ SULPHAS, U. S.—**Sulphate of Atropine.** $(C_{17}H_{23}NO_3)_2H_2SO_4$; 676.—A white, indistinctly crystalline powder, permanent in the air; odorless; very bitter, nauseating taste; neutral reaction. Prepared by treating the alkaloid with dilute sulphuric acid, and evaporating at a temperature not exceeding 37.7° C. (100 F.).

HYOSCYAMUS, U. S.—**Hyoscyamus.** (*Hyoscyami Folia, Pharm. 1870. Henbane.*)—The leaves of *Hyoscyamus nigra*, collected from plants of the second year's growth and containing hyoscyamine, $C_{17}H_{23}NO_3$; hyoscine, $C_{17}H_{23}NO_3$; hyoscypicrin, $C_{27}H_{52}O_{14}$; chlorophyl, mucilage, extractive matter, etc.

Abstractum Hyoscyami, U. S.—Abstract of Hyoscyamus.

Extractum Hyoscyami Alcoholicum, U. S.—Alcoholic Extract of Hyoscyamus.

Extractum Hyoscyami Fluidum, U. S.—Fluid Extract of Hyoscyamus.

Tinctura Hyoscyami, U. S.—Tincture of Hyoscyamus.

HYOSCYAMINÆ SULPHAS, U. S.—**Sulphate of Hyoscyamine.** $(C_{17}H_{23}NO_3)_2.H_2SO_4$; 676.—Small, golden-yellow, or yellowish-white scales or crystals, or a yellowish white amorphous powder, deliquescent on exposure to air; odorless; having a bitter and acrid taste, and

a neutral reaction. Prepared by treating an acidulated tincture of the seeds, after separating the fixed oil, with soda, precipitating with tannin, mixing the precipitate with lime, exhausting with alcohol, acidulating, concentrating, agitating with ether, to remove coloring matter and oil, afterward decolorizing and recrystallizing.

STRAMONII FOLIA, U. S.—Stramonium Leaves.—The leaves of *Datura stramonium*.

STRAMONII SEMEN, U. S.—Stramonium Seed.—The seed of *Datura stramonium*. Stramonium contains *daturine* (a mixture of hyoscyamine and atropine); the leaves also contain albumen, mucilage and potassium nitrate, while in the seeds exist about 25 per cent. of fixed oil, with resins, mucilage, etc.

Extractum Stramonii, U. S.—Extract of Stramonium.

Extractum Stramonii Fluidum, U. S.—Fluid Extract of Stramonium.

Tinctura Stramonii, U. S.—Tincture of Stramonium.

Unguentum Stramonii, U. S.—Stramonium Ointment.

DULCAMARA, U. S.—Dulcamara. (*Bittersweet.*)—The young branches of *Solanum dulcamara*, containing solanine (alkaloid) and *dulcamarine*, $C_{22}H_{34}O_{10}$ (glucoside), (the latter is the bitter and sweet principle), gum, wax, fat, resin, etc.

Extractum Dulcamaræ Fluidum, U. S.—Fluid Extract of Dulcamara.

PILOCARPUS, U. S.—Pilocarpus. (*Jaborandi.*)—The leaflets of *Pilocarpus pennatifolius*, containing *pilocarpine*, $C_{11}H_{16}N_2O_2$, and volatile oil, consisting principally of *pilocarpene*, $C_{10}H_{16}$, a terpene.

Extractum Pilocarpi Fluidum, U. S.—Fluid Extract of Pilocarpus.

PILOCARPINÆ HYDROCHLORAS, U. S.—Hydrochlorate of Pilocarpine. $C_{11}H_{16}N_2O_2.HCl$; 244.4.—Minute, white crystals, deliquescent; odorless; faintly bitter taste; neutral reaction. Prepared by treating pilocarpine with dilute HCl, concentrating and crystallizing.

COLCHICI RADIX, U. S.—Colchicum Root.—The corm of *Colchicum autumnale*.

COLCHICI SEMEN, U. S.—Colchicum Seed.—The seed of *Colchicum autumnale*. Colchicum contains the alkaloid *colchicine*, both in corm and seed. In the former there are present starch, gum, fat, sugar, resin, etc. In the latter a fixed oil is found in addition to the other principles. The alkaloid may be extracted by digesting the seeds in hot alcohol without powdering them.

Extractum Colchici Radicis, U. S.—Extract of Colchicum Root.

Extractum Colchici Radicis Fluidum, U.S.—Fluid Extract of Colchicum Root.

Vinum Colchici Radicis, U. S.—Wine of Colchicum Root.

Extractum Colchici Seminis Fluidum, U. S.—Fluid Extract of Colchicum Seed.

Tinctura Colchici, U. S.—Tincture of Colchicum (seed).

Vinum Colchici Seminis, U. S.—Wine of Colchicum Seed.

VERATRUM VIRIDE, U. S.—Veratrum Viride. (*American hellebore.*)—The rhizome and rootlets of *Veratrum viride*, containing the alkaloids *jervine*, *veratroidine*, *pseudojervine* and *rubijervine*, also resins, starch, coloring matter, etc.

Extractum Veratri Viridis Fluidum, U. S.—Fluid Extract of Veratrum Viride.

Tinctura Veratri Viridis, U. S.—Tincture of Veratrum Viride.

VERATRINA, U. S.—Veratrine.—An alkaloid, or mixture of alkaloids, prepared from the seeds of *Asagræa officinalis*, occurring in the form of a white or grayish-white, amorphous, rarely crystalline powder, permanent in the air; odorless; of a distinctive, acrid taste, leaving a sensation of tingling and numbness on the tongue, producing constriction of the fauces and highly irritant to the nostrils. Prepared by exhausting the seeds with alcohol, recovering the alcohol by distillation, diluting the residuary liquid, which contains veratrine in its natural combination with veratric acid, with water, to precipitate the resins, filtering, adding potassa or ammonia, to precipitate the alkaloid, redissolving, decolorizing, and reprecipitating.

Oleatum Veratrinæ, U. S.—Oleate of Veratrine.

Unguentum Veratrinæ, U. S.—Ointment of Veratrine.

CHELIDONIUM, U. S.—Chelidonium. (*Celandine.*)—*Chelidonium majus* contains *chelerythrine*, *chelidonine*, $C_{15}H_{17}N_3O_3$, *chelidoxanthin* and *chelidonic acid*.

SANGUINARIA, U. S.—Sanguinaria. (*Bloodroot.*)—The rhizome of *Sanguinaria canadensis*, collected in autumn, and containing *sanguinarine*, $C_{19}H_{17}NO_4$, a colorless alkaloid, which yields bright red salts; another unnamed alkaloid; also malic and citric acid, starch, resins, coloring-matter, etc.

Acetum Sanguinariæ, U. S.—Vinegar of Sanguinaria.

Extractum Sanguinariæ Fluidum, U. S.—Fluid Extract of Sanguinaria.

Tinctura Sanguinariæ, U. S.—Tincture of Sanguinaria.

STAPHISAGRIA, U. S.—Staphisagria. (*Stavesacre.*)—The seed of *Delphinium staphisagria*, containing three alkaloids, *delphinine*, *delphisine*, and *delphinoidine*, also, *staphisain*, with fixed oil, protein compounds, etc.

ACONITUM, U. S.—Aconite.—The tuberous root of *Aconitum napellus*, containing *aconitine*, $C_{33}H_{43}NO_{12}$; *pseudaconitine*, $C_{26}H_{49}N_{11}$; *picraconitine*, $C_{31}H_{45}NO_{11}$; *aconine*, $C_{26}H_{39}NO_{11}$; *pseudaconine*, $C_{27}H_{11}NO_8$; *aconitic acid*, $H_3C_6H_3O_6$; together with resin, sugar, fat, coloring matter, etc. *Aconitic acid* may be produced by heating citric acid to 155° C. (311° F.).

Abstractum Aconiti, U. S.—Abstract of Aconite.

Extractum Aconiti, U. S.—Extract of Aconite.

Extractum Aconiti Fluidum, U. S.—Fluid Extract of Aconite.

Tinctura Aconiti, U. S.—Tincture of Aconite.

Tartaric acid is used with the alcohol in extracting aconite, to aid in abstracting the aconitine, although its use is unnecessary.

HYDRASTIS, U. S.—Hydrastis. (*Golden Seal.*)—The rhizome and rootlets of *Hydrastis canadensis*, containing *hydrastine*, $C_{22}H_{23}NO_6$; *berberine*, $C_{20}H_{17}NO_4$; xanthopuccine, sugar, starch, resin, coloring matter, etc.

Extractum Hydrastis Fluidum, U. S.—Fluid Extract of Hydrastis.

Tinctura Hydrastis, U. S.—Tincture of Hydrastis.

MENISPERMUM, U. S.—Menispermum. (*Canadian Moonseed.*)—The rhizome and rootlets of *Menispermum canadense*, containing *menispine*, *berberine*, resin, starch, tannin, coloring matter, etc.

GRANATUM, U. S.—Pomegranate.—The bark of the root of *Punica granatum*, containing four alkaloids: *pelletierine*, *isopelletierine*, *methylpelletierine*, *pseudopelletierine*. The first three are liquid, the latter solid and crystalline. The drug also contains punico-tannic acid, $C_{20}H_{16}O_{13}$, sugar, mannit, pectin, gum, etc.

PAREIRA, U. S.—Pareira. (*Pareira Brava.*)—The root of *Chondodendron tomentosum*, containing *pelosine* or *cissampeline*, which is identical with buxine and beberine, alkaloids obtained from buxus sempervirens and nectandra rodiæi.

Extractum Pareiræ Fluidum, *U. S.*—Fluid Extract of Pareira.

IPECACUANHA, U. S.—Ipecac.—The root of *Cephaëlis Ipecacuanha*, containing emetine, $C_{28}H_{40}N_2O_5$, ipecacuanhic acid, pectin, starch, resin, sugar, etc.

Extractum Ipecacuanhæ Fluidum, *U. S.*—Fluid Extract of Ipecac.

Trochisci Ipecacuanhæ, *U. S.*—Troches of Ipecac.

Syrupus Ipecacuanhæ, *U. S.*—Syrup of Ipecac.

Tinctura Ipecacuanhæ et Opii, *U. S.*—Tincture of Ipecac and Opium.

Vinum Ipecacuanhæ, *U. S.*—Wine of Ipecac.

Pulvis Ipecacuanhæ et Opii, *U. S.*—Powder of Ipecac and Opium.

ERYTHROXYLON, U. S.—Erythroxylon. (*Coca.*)—The leaves of *Erythroxylon coca* contain *cocaine*, $C_{17}H_{21}NO_4$, and *hygrine* combined with cocatannic acid.

Extractum Erythroxyli Fluidum, *U. S.*—Fluid Extract of Erythroxylon.

GUARANA, U. S.—Guarana.—A dried paste prepared from the crushed or ground seeds of *Paullinia sorbilis*, containing *caffeine*, $C_8H_{10}N_4O_2$, about 25 per cent. of tannin, resin, mucilage, starch, volatile oil, saponin, etc.

Extractum Guaranæ Fluidum, *U. S.*—Fluid Extract of Guarana.

CAFFEINA, U. S.—Caffeine. $C_8H_{10}N_4O_2$; 212.—A proximate principle, of feebly alkaloid power, generally prepared from the dried leaves of *Camellia Thea*, or from the dried seeds of *Coffea arabica*, or from *Guarana*, and occurring also in other plants. Colorless, soft and flexible crystals, generally quite long and of a silky lustre, permanent in the air; odorless; bitter taste; neutral reaction. Obtained from a decoction of tea or coffee by precipitating with lead acetate, removing the lead by H_2S, adding AmHO, evaporating and recrystallizing.

CONIUM, U. S.—Conium. (*Hemlock.*)—The full-grown fruit of *Conium maculatun*, gathered while yet green, and containing *conine*, $C_8H_{17}N$; *conhydrine*, $C_8H_{17}NO$; and *methylconine*, $C_8H_{16}CH_3N$; also a little volatile oil and fixed oil. Conium is a liquid volatile alkaloid, containing no oxygen, and with an odor resembling that of the urine of mice.

Abstractum Conii, *U. S.*—Abstract of Conium.

Extractum Conii Alcoholicum, *U. S.*—Alcoholic Extract of Conium.

Extractum Conii Fluidum, *U. S.*—Fluid Extract of Conium.

Tinctura Conii, *U. S.*—Tincture of Conium.

LOBELIA, U. S.—Lobelia.—The leaves and tops of *Lobelia inflata*, collected after a portion of the capsules have been inflated, contain *lobeline*, *lobelic acid*, *lobelacrin*, wax, resin, gum, etc. *Lobeline* is a liquid alkaloid, and contains no oxygen.

Acetum Lobeliæ, U. S.—Vinegar of Lobelia.
Extractum Lobeliæ Fluidum, U. S.—Fluid Extract of Lobelia.
Tinctura Lobeliæ, U. S.—Tincture of Lobelia.

TABACUM, U. S.—Tobacco.—The commercial dried leaves of *Nicotiana tabacum*, containing nicotine, $C_{10}H_{14}N_2$, a liquid alkaloid, which is colorless, very acrid, poisonous and rapidly turns brown on exposure to air; soluble in water, alcohol and ether.

PRODUCTS FROM ANIMAL SUBSTANCES.

The animal products of pharmaceutical interest are not numerous, but some of them are very important. Their chemical composition is not very well understood.

Officinal Products Derived from the Class Mammalia.

ADEPS, U. S.—Lard.—The prepared internal fat of the abdomen of *Sus scrofa* (Class, *Mammalia*, Ord., *Pachydermata*), purified by washing with water, melting and straining. Lard should be preserved in securely-closed vessels, impervious to fat. It is a soft, white, unctuous solid. It melts at or near 35° C. (95° F.) to a clear, colorless liquid, and at or below 30° C. (86° F.) it is a soft solid; sp. gr. about 0.938; faint odor, free from rancidity; bland taste; neutral reaction; entirely soluble in ether, benzin and disulphide of carbon.

ADEPS BENZOINATUS, U. S.—Benzoinated Lard. (*Unguentum Benzoini, Pharm. 1870.*)—Benzoin 2. p., Lard 100 p.

OLEUM ADIPIS, U. S.—Lard Oil.—A fixed oil expressed from lard at a low temperature.

SEVUM, U. S.—Suet.—The internal fat of the abdomen of *Ovis aries* (Class, *Mammalia;* Order, *Ruminantia*), purified by melting and staining. Suet should be kept in well-closed vessels impervious to fat. It should not be used after it has become rancid. It is a white, smooth, solid fat; nearly inodorous, gradually becoming rancid on exposure to air; bland taste, neutral reaction.

PEPSINUM SACCHARATUM, U. S.—Saccharated Pepsin.—Pepsin, the digestive principle of the gastric juice, obtained from the mucous membrane of the stomach of the hog, and mixed with powdered sugar of milk.

Preparation.—Prof. Scheffer's Process: Macerate mucous membranes of hogs' stomachs in very dilute HCl, precipitate pepsin with NaCl, skim, drain, dry and dilute with sugar of milk until 10 grs. will dissolve 500 grs. coagulated albumen. Saccharated pepsin is a white powder; slight but not disagreeable odor; slight but not disagreeable taste. It is not completely soluble in water, leaving floccules of pepsin floating in the solution, which, however, dissolve on the addition of a small quantity of hydrochloric acid.

LIQUOR PEPSINI, U. S.—Solution of Pepsin. (*Liquid Pepsin.*)—Saccharated Pepsin 40 p.; Hydrochloric Acid 12 p.; Glycerin 400 p.; Water 548 p.

MOSCHUS, U. S.—Musk.—The dried secretion from the preputial follicles of *Moschus moschiferus* (Class, *Mammalia;* Order, *Ruminantia*)

contains cholesterin, ammonia, an acid principle, wax, fat, albuminous and gelatinous principles, and an odorous matter not yet determined.

Tinctura Moschi, U. S.—Tincture of Musk.

ACIDUM LACTICUM, U. S.—Lactic Acid.—A liquid composed of 75 per cent. of absolute lactic acid ($HC_3H_5O_3$; 90) and 25 per cent. of water; made from sour milk, cheese, meat juice, lactin and from many vegetable products. Cane sugar is treated with sulphuric acid, so as to convert it into invert sugar, solution of caustic soda added, and the mixture heated until it ceases to precipitate Fehling's solution, showing the absence of sugar. Sulphuric acid is added, and the sodium sulphate formed is crystallized out, an addition of alcohol causing the precipitation of the remainder. The alcoholic liquid contains impure lactic acid; one-half of it is heated and zinc carbonate added until effervescence ceases; the other half of the alcoholic liquid is now added, and the whole allowed to cool. Zinc lactate crystallizes out; this, by treatment with hydrosulphuric acid, yields zinc sulphide, lactic acid remaining in solution. Acidum lacticum is a nearly colorless liquid; sp. gr. 1.212; odorless; very acid taste; acid reaction; freely miscible with ether, but nearly insoluble in chloroform.

SACCHARUM LACTIS, U. S.—Sugar of Milk. $C_{12}H_{22}O_{11}.H_2O$; 360.—A peculiar, crystalline sugar obtained from the whey of cow's milk by evaporation and purified by recrystallization. It occurs in the form of white, hard, crystalline masses, yielding a white powder feeling gritty on the tongue, permanent in the air; odorless; faintly sweet taste; neutral reaction.

FEL BOVIS, U.S.—Ox Gall.—The fresh gall of *Bos taurus* (Class, *Mammalia;* Order, *Ruminantia*) contains *glycocholic acid*, $C_{26}H_{43}NO_6$; *taurocholic acid*, $C_{26}N_{15}NSO_7$; *hyoglycocholic acid*, $C_{27}H_{43}NO_5$; *hyotaurocholic acid*, $C_{27}H_{45}NSO_6$, and *chenotaurocholic acid*, $C_{29}H_{49}NSO_6$. A brownish-green or dark-green, somewhat viscid liquid, having a peculiar odor; a disagreeable, bitter taste, and a neutral or faintly alkaline reaction; sp. gr. 1.018–1.028.

FEL BOVIS INSPISSATUM, U. S.—Inspissated Ox Gall.—Fresh Ox Gall. 100 p.; to make 15 p. Heat the ox gall to a temperature not exceeding 80° C. (176° F.), strain it through muslin, and evaporate the strained liquid, on a water-bath, in a porcelain capsule, to *fifteen parts*.

FEL BOVIS PURIFICATUM, U. S.—Purified Ox Gall.—Fresh Ox Gall 3 p.; Alcohol 1 p. Evaporate the ox gall in a porcelain capsule, on a water-bath, to *one part*, then add to it the alcohol, agitate the mixture thoroughly, and let it stand, well covered, for twenty-four hours. Decant the clear solution, filter the remainder, and, having mixed the liquids and distilled off the alcohol, evaporate to a pilular consistence.

Officinal Products of the Class Pisces.

ICHTHYOCOLLA, U. S.—Isinglass.—The swimming bladder of *Acipenser huso*, and of other species of *Acipenser* (Class, *Pisces;* Order, *Sturiones*).

Emplastrum Ichthyocollæ, U. S.—Isinglass Plaster.

CETACEUM, U. S.—Spermaceti.—A peculiar, concrete, fatty substance, obtained from *Physeter macrocephalus* (Class, *Mammalia;* Order, *Cetacea*) contains *cetin*, *cetin-elain*, which, when saponified, yield *cetin-*

elaic acid, an acid resembling, but distinct from, oleic acid. The cetin is essentially *cetyl palmitate*, $C_{16}H_{31}(C_{16}H_{33}O_2)$. There are small amounts of fats containing *stearic acid*, $C_{18}H_{36}O_2$; *myristic acid*, $C_{14}H_{28}O_2$; and *lauro-stearic acid*, $C_{12}H_{24}O_2$, and the alcohol radicals corresponding to these acids.

Ceratum Cetacei, U. S.—Spermaceti Cerate.

OLEUM MORRHUÆ, U. S.—Cod-Liver Oil.—A fixed oil obtained from the fresh livers of *Gadus morrhua*, or of other species of *Gadus* (Class, *Pisces;* Order, *Teleostia;* Family, *Gadida*).

Preparation.—Heat the livers in a wooden tank by means of low-pressure steam, and drain off the oil. In the case of the finest varieties, the oil, which is made only in the winter months, is drawn off by taps from the bottom of the cooking tank, and then put into a cooling house, to freeze. The solid frozen mass is put into canvas bags, and submitted, while at a low temperature, to severe pressure, whereby the pure oil is expressed. This constitutes the light oil of commerce. Cod-liver oil consists chiefly of olein, some palmitin and stearin, with minute traces of iodine, chlorine, bromine, phosphorus and sulphur. Oleum Morrhuæ is a colorless or pale-yellow, thin, oily liquid. When cooled to near 0° C. (32° F.), a white, granular matter separates; sp. gr. 0.920–0.925; slightly fishy odor; bland, slightly fishy taste; faintly acid reaction.

Officinal Products of the Class Aves.

VITELLUS, U. S.—Yolk of Egg.—The yolk of the egg of *Gallus bankiva*, var. *domesticus* (Class, *Aves;* Order, *Gallinæ*), contains *vitellin*, a protein compound resembling casein, albumen, fat, cholesterin, inorganic salts, coloring matter, etc.; water 50 per cent. *White of egg* consists principally of albumen, with 80 per cent of water. The inorganic salt present in largest proportion is potassium chloride.

Glyceritum Vitelli, U. S.—Glycerite of Yolk of Egg.

Officinal Products of the Class Insecta.

CANTHARIS, U. S.—Cantharides. (*Spanish Flies.*)—*Cantharis vesicatoria* (Class, *Insecta;* Order, *Coleoptera*). Cantharides should be kept in well-closed vessels containing a little camphor. Cantharides owe their blistering properties to *cantharidin*, $C_{10}H_{12}O_4$, a white substance, in the form of crystalline scales, of a shining micaceous appearance; inodorous; tasteless.

Ceratum Cantharidis, U. S.—Cantharides Cerate.

Ceratum Extracti Cantharidis, U. S.—Cerate of Extract of Cantharides.

Charta Cantharidis, U. S.—Cantharides Paper.

Collodium cum Cantharide, U. S.—Collodion with Cantharides.

Linimentum Cantharidis, U. S.—Cantharides Liniment.

Tinctura Cantharidis, U. S.—Tincture of Cantharides.

COCCUS, U. S.—Cochineal.—The dried female of *Coccus cacti* (Class, *Insecta;* Order, *Hemiptera*) owes its red color to carminic acid, $C_{17}H_{18}O_{10}$. It contains mucilage, fat, inorganic salts, etc.

CERA FLAVA, U. S.—Yellow Wax.—A peculiar, concrete substance, prepared by *Apis mellifica* (Class, *Insecta;* Order, *Hymenoptera*).

CERA ALBA, U. S.—White Wax.—Yellow wax bleached. A yellowish or brownish yellow solid. It is brittle when cold, but becomes plastic by the heat of the hand. It melts at 63°–64° C. (145.4°–147.2° F.), and congeals with a smooth and level surface; sp. gr. 0.955–0.967; agreeable, honey-like odor; faint, balsamic taste. Beeswax is a mixture of three different substances, which may be separated from one another by alcohol, viz., 1, *myricin*, insoluble in boiling alcohol, and consisting chiefly of myricil palmitate, $C_{16}H_{31}(C_{30}H_{61}O_2)$, which is a compound of *palmitic acid*, $C_{16}H_{32}O_2$, and *myricyl alcohol*, $C_{30}H_{62}O$; 2, *cerotic acid*, $C_{27}H_{54}O_2$ (formerly called *cerin* when obtained only in an impure state), which is dissolved by boiling alcohol, but crystallizes out on cooling; 3, *cerolein*, which remains dissolved in the cold alcoholic liquid. This latter is probably a mixture of fatty acids, as indicated by its acid reaction to litmus paper. (Remington.)

TABLES FOR CONVERTING U. S. WEIGHTS AND

LINEAR.

	Inches to millimetres.	*Feet to metres.*	*Yards to metres.*	*Miles to kilometres.*
1 =	25.4000	0.304801	0.914402	1.60935
2 =	50.8001	0.609601	1.828804	3.21869
3 =	76.2001	0.914402	2.743205	4.82804
4 =	101.6002	1.219202	3.657607	6.43739
5 =	127.0002	1.524003	4.572009	8.04674
6 =	152.4003	1.828804	5.486411	9.65608
7 =	177.8003	2.133604	6.400813	11.26543
8 =	203.2004	2.438405	7.315215	12.87478
9 =	228.6004	2.743205	8.229616	14.48412

SQUARE.

	Square inches to square centimetres.	*Square feet to square decimetres.*	*Square yards to square metres.*	*Acres to hectares.*
1 =	6.452	9.290	0.836	0.4047
2 =	12.903	18.581	1.672	0.8094
3 =	19.355	27.871	2.508	1.2141
4 =	25.807	37.161	3.344	1.6187
5 =	32.258	46.452	4.181	2.0234
6 =	38.710	55.742	5.017	2.4281
7 =	45.161	65.032	5.853	2.8328
8 =	51.613	74.323	6.689	3.2375
9 =	58.065	83.613	7.525	3.6422

CUBIC.

	Cubic inches to cubic centimetres.	*Cubic feet to cubic metres.*	*Cubic yards to cubic metres.*	*Bushels to hectolitres.*
1 =	16.387	0.02832	0.765	0.35242
2 =	32 774	0.05663	1.529	0.70485
3 =	49.161	0.08495	2.294	1.05727
4 =	65.549	0.11327	3.058	1.40969
5 =	81.936	0.14158	3.823	1.76211
6 =	98.323	0.16990	4.587	2.11454
7 =	114.710	0.19822	5.352	2.46696
8 =	131.097	0.22654	6.116	2.81938
9 =	147.484	0.25485	6.881	3.17181

The only authorized material standard of customary length is the Troughton scale The yard in use in the United States is therefore equal to the British yard.

The only authorized material standard of customary weight is the Troy pound of the It was derived from the British standard Troy pound of 1758 by direct comparison. The The grain Troy is therefore the same as the grain Avoirdupois, and the pound Avoir

The British gallon = 4.54346 litres.

The British bushel = 36.3477 litres.

AND MEASURES—CUSTOMARY TO METRIC.

CAPACITY.

	Fluid drachms to millilitres or cubic centimetres.	*Fluid ounces to millilitres.*	*Quarts to litres.*	*Gallons to litres.*
1 =	3.70	29.57	0.94636	3.78544
2 =	7.39	59.15	1.89272	7.57088
3 =	11.09	88.72	2.83908	11.35632
4 =	14.79	118.30	3.78544	15.14176
5 =	18.48	147.87	4.73180	18.92720
6 =	22.18	177.44	5.67816	22.71264
7 =	25.88	207.02	6.62452	26.49808
8 =	29.57	236.59	7.57088	30.28352
9 =	33.28	266.16	8.51724	34.06896

WEIGHT.

	Grains to milligrammes.	*Avoirdupois ounces to grammes.*	*Avoirdupois pounds to kilogrammes.*	*Troy ounces to grammes.*
1 =	64.7989	28.3495	0.45359	31.10348
2 =	129.5978	56.6991	0.90719	62.20696
3 =	194.3968	85.0486	1.36078	93.31044
4 =	259.1957	113.3981	1.81437	124.41392
5 =	323.9946	141.7476	2.26796	155.51740
6 =	388.7935	170.0972	2.72156	186.62089
7 =	453.5924	198.4467	3.17515	217.72437
8 =	518.3914	226.7962	3.62874	248.82785
9 =	583.1903	255.1457	4.08233	279.93133

1 chain	=	20.1169	metres.
1 square mile	=	259	hectares.
1 fathom	=	1.829	metres.
1 nautical mile,	=	1853.27	metres.
1 foot	= 0.304801 metre,	9.4840158	log.
1 avoir. pound	=	453.5924277	gramme.
15432.35639 grains	=	1	kilogramme.

belonging to this office, whose length at 59°.62 Fahr. conforms to the British standard.

Mint. It is of brass of unknown density, and therefore not suitable for a standard of mass. British Avoirdupois pound was also derived from the latter, and contains 7000 grains Troy. dupois in use in the United States is equal to the British pound Avoirdupois.

WASHINGTON, D. C., January, 1890.

By Permission of T. C. MEN

TABLE FOR CONVERTING U. S. WEIGHTS

LINEAR.

	Metres to inches.	*Metres to feet.*	*Metres to yards.*	*Kilometres to miles.*
1 =	39.3700	3.28083	1.093611	0.62137
2 =	78.7400	6.56167	2.187222	1.24274
3 =	118.1100	9.84250	3.280833	1.86411
4 =	157.4800	13.12333	4.374444	2.48548
5 =	196.8500	16.40417	5.468056	3.10685
6 =	236.2200	19.68500	6.561667	3.72822
7 =	275.5900	22.96583	7.655278	4.34959
8 =	314.9600	26.24667	8.748889	4.97096
9 =	354.3300	29.52750	9.842500	5.59233

SQUARE.

	Square centimetres to square inches.	*Square metres to square feet.*	*Square metres to square yards.*	*Hectares to acres.*
1 =	0.1550	10.764	1.196	2.471
2 =	0.3100	21.528	2.392	4.942
3 =	0.4650	32.292	3.588	7.413
4 =	0.6200	43.055	4.784	9.884
5 =	0.7750	53.819	5.980	12.355
6 =	0.9300	64.583	7.176	14.826
7 =	1.0850	75.347	8.372	17.297
8 =	1.2400	86.111	9.568	19.768
9 =	1.3950	96.874	10.764.	22.239

CUBIC.

	Cubic centimetres to cubic inches.	*Cubic decimetres to cubic inches.*	*Cubic metres to cubic feet.*	*Cubic metres to cubic yards.*
1 =	0.0610	61.023	35.314	1.308
2 =	0.1220	122.047	70.629	2.616
3 =	0.1831	183.070	105.943	3.924
4 =	0.2441	244.093	141.258	5.232
5 =	0.3051	305.117	176.572	6.540
6 =	0.3661	366.140	211.887	7.848
7 =	0.4272	427.163	247.201	9.156
8 =	0.4882	488.187	282.516	10.464
9 =	0.5492	549.210	317.830	11.771

By the concurrent action of the principal governments of the world an International
of the International Committee, two ingots were cast of pure platinum-iridium in the
certain number of kilogrammes were prepared, from the other a definite number of
preference, and certain ones were selected as International prototype standards. The
prototype standards. Those apportioned to the United States are in the keeping of

The metric system was legalized in the United States in 1866.

The International Standard Metre is derived from the Metre des Archives, and its
iridium bar deposited at the International Bureau of Weights and Measures.

The International Standard Kilogramme is a mass of platinum-iridium deposited at the

The litre is equal to a cubic decimetre of water, and it is measured by the quantity
kilogramme in a vacuum, the volume of such a quantity of water being, as nearly as has

AND MEASURES—METRIC TO CUSTOMARY.

CAPACITY.

	Millimetres or cubic centimetres to fluid drachms.	*Centilitres to fluid ounces*	*Litres to quarts.*	*Decalitres to gallons.*	*Hectolitres to bushels.*
1 =	0.27	0.338	1.0567	2.6417	2.8375
2 =	0.54	0.676	2.1134	5.2834	5.6750
3 =	0.81	1.014	3.1700	7.9251	8.5125
4 =	1.08	1.352	4.2267	10.5668	11.3500
5 =	1.35	1.691	5.2834	13.2085	14.1875
6 =	1.62	2.029	6.3401	15.8502	17.0250
7 =	1.89	2.368	7.3968	18.4919	19.8625
8 =	2.16	2.706	8.4534	21.1336	22.7000
9 =	2.43	3.043	9.5101	23.7753	25.5375

WEIGHT.

	Milligrammes to grains.	*Kilogrammes to grains.*	*Hectogrammes (100 grammes) to ounces Av.*	*Kilogrammes to pounds Avoirdupois.*
1 =	0.01543	15432.36	3.5274	2.20462
2 =	0.03086	30864.71	7.0548	4.40924
3 =	0.04630	46297.07	10.5822	6.61386
4 =	0.06173	61729.43	14.1096	8.81849
5 =	0.07716	77161.78	17.6370	11.02311
6 =	0.09259	92594.14	21.1644	13.22773
7 =	0.10803	108026.49	24.6918	15.43235
8 =	0.12346	123458.85	28.2192	17.63697
9 =	0.13889	138891.21	31.7466	19.84159

WEIGHT—(CONTINUED).

	Quintals to pounds Av.	*Milliers or tonnes to pounds Av.*	*Grammes to ounces, Troy.*
1 =	220.46	2204.6	0.03215
2 =	440.92	4409.2	0.06430
3 =	661.38	6613.8	0.09645
4 =	881.84	8818.4	0.12860
5 =	1102.30	11023.0	0.16075
6 =	1322.76	13227.6	0.19290
7 =	1543.22	15432.2	0.22505
8 =	1763.68	17636.8	0.25721
9 =	1984.14	19841.4	0.28936

Bureau of Weights and Measures has been established near Paris. Under the direction
proportion of nine parts of the former to one of the latter metal. From one of these a
metre bars. These standards of weight and length were intercompared, without
others were distributed by lot to the different governments, and are called National
this office.

length is defined by the distance between two lines at 0° Centigrade, on a platinum-

same place, and its weight in vacuo is the same as that of the Kilogramme des Archives.
of distilled water which, at its maximum density, will counterpoise the standard
been ascertained, equal to a cubic decimetre.

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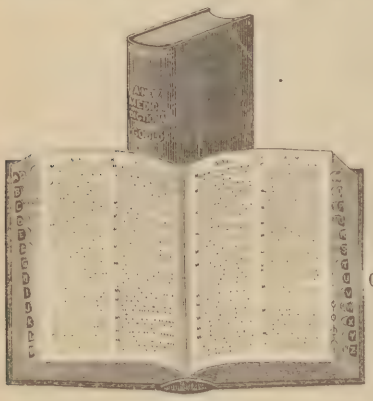

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